

MINING CONGRESS JOURNAL

JULY, 1939



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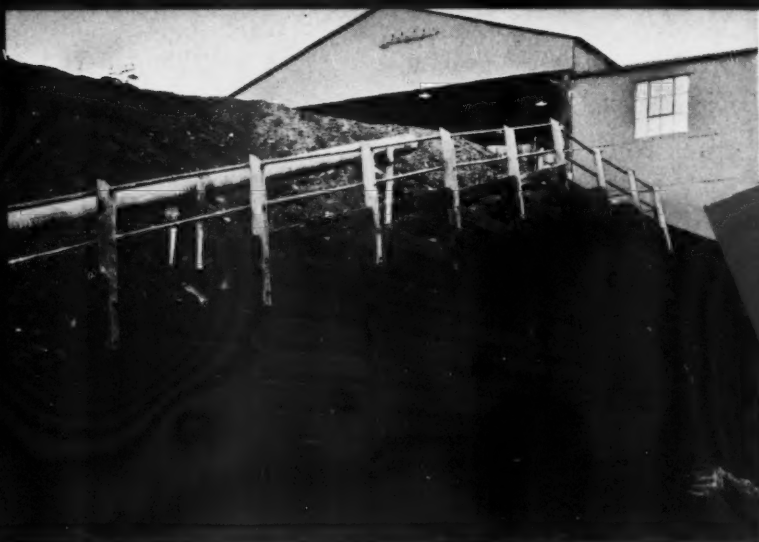
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AND MINES

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February 28, 1939

Timken Roller Bearing Company
Canton, Ohio

Gentlemen:

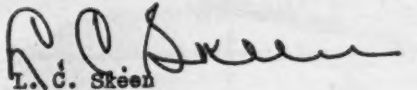
I have your request relative to our experience with Timken Roller Bearings in mine cars.

At the present time we have in service approximately 1,400 mine cars equipped with Timken bearings. The first cars with Timken Roller Bearings were put in service in the year 1923 and all cars purchased and put in service since that date have been equipped with Timken bearings.

Recently this company purchased 100 new cars and these cars were equipped with Timken Roller Bearings and the bearings going into these cars were salvaged from old cars which had been in service considerable time and had been dismantled. Some of these bearings had been in service from 1923 up until recently, just prior to the acquirement of the new cars. All of the bearings installed in the above mentioned mine cars were salvaged bearings from cars that had been dismantled and before being placed in the new cars were inspected by your representative and approved as being in suitable condition for the installation in the new cars.

I can state that the service from these bearings has been very satisfactory and is verified by the fact that in the last 100 cars purchased by this company, only salvaged Timken bearings were used. The service obtained from these bearings speaks for your product.

Yours very truly,
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L.C. Skien

Vice Pres and Gen Mgr.

LCS:D

How to Get the Most Out of Your Rock Drills



I won't use bad shanks in my headings . . .

When I was running a drill, bad shanks caused me plenty of trouble. Sometimes they would be too soft and stick in the chuck. At other times, they would be too hard and chip. These chips usually ruined a drill by scoring the cylinder or spalling off the end of the piston. This meant a lot of lost hours.

I also used to get plenty sore when the man on the next drill finished up ahead of me just because my shanks were too long or too short and kept me from getting full drilling speed out of my machine.

Now that I am a shift boss, I naturally expect the best out of each of my men and I see that they get good steel so that they can do a good job. I don't want anything to hold up my headings and raise my costs so I just naturally won't have bad shanks at the face. When I find one, I sure get plenty tough. Wouldn't you?

Please Note

This is one of a series of talks intended to create a greater awareness of operating conditions, so that the users of rock drills can more nearly get out of their machines what the Ingersoll-Rand Company's designers, engineers, and metallurgists have built into them. Reprints of this talk or of any of the series may be obtained for your bulletin boards, for use as payroll stuffers, etc.

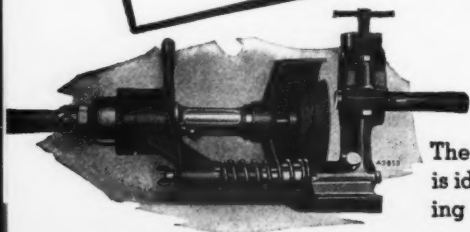


Bad Shanks Delay You and Increase Your Drilling Costs

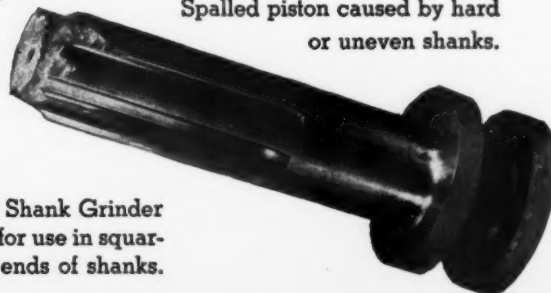
1. Soft shanks upset and stick in the drill.
2. Hard shanks spall the piston.
3. Hard shanks also chip and the small pieces of steel are apt to ruin the drill cylinder.
4. Short shanks cut down the drill's force of blow and reduce drilling speed.
5. Long shanks shorten the piston stroke and slow up drilling.
6. Round shanks, chipped shanks and shanks with too much bevel concentrate the force of blow at one spot on the piston. This breaks pistons. Shanks should be square.

Spalled piston caused by hard or uneven shanks.

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Our eight years of experience with these batteries have proved that we made no mistake, as they have given us splendid service, performing their work day in and day out without breakdowns or any major repairs. They have substantiated in every respect your claims of high power ability, high efficiency, great ruggedness and long life. As additional locomotives were required, we added Exide-Ironclad batteries to our fleet, and now have a total of six in service.

The first of these batteries replaced gave 66 months life. The second gave 71 months life. The service which your Exide-Ironclad batteries and your company have rendered us has been highly satisfactory in every respect and we take pleasure in sending you this word of appreciation.

Very truly yours,

James Spiers, Supt.

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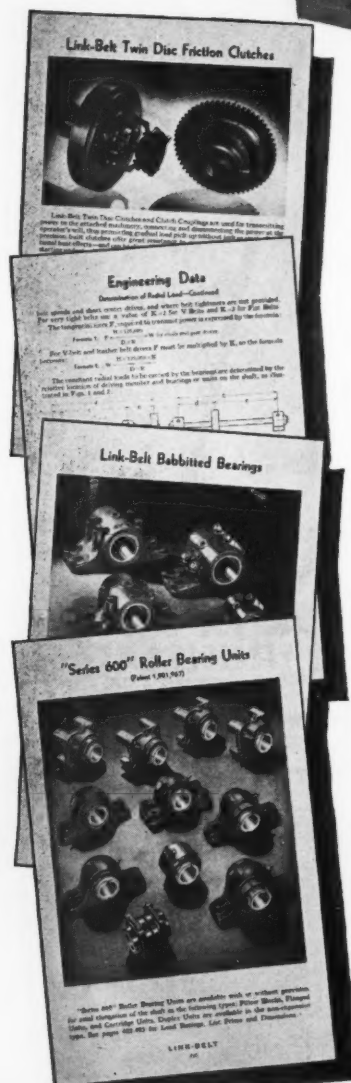
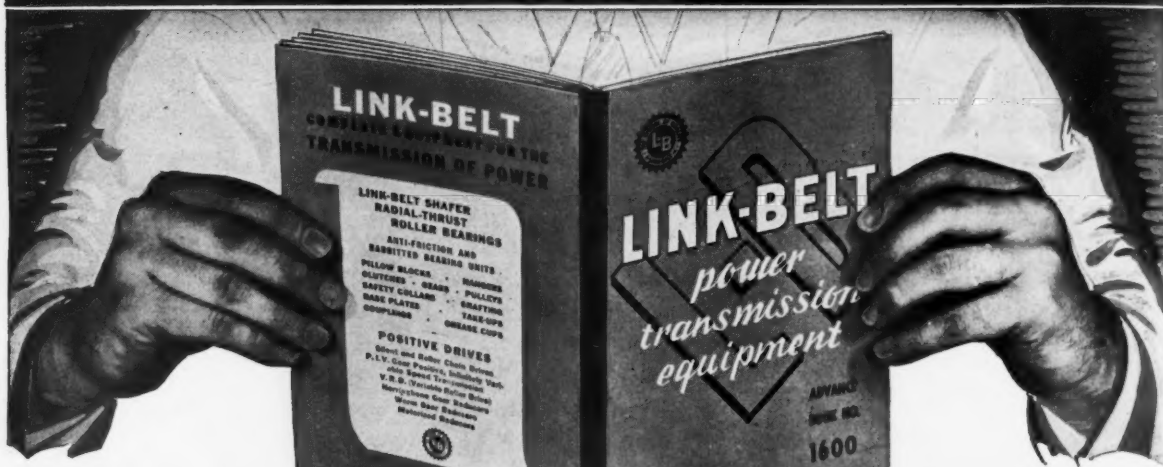
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The World's Largest Manufacturers of Storage Batteries for Every Purpose
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JULY, 1939

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Between the covers of this new book are presented in convenient, compact form, complete engineering and reference data on—self-aligning anti-friction ball and roller bearing units, newly designed for greater life . . . babbitted bearing units for every service . . . welded steel base plates . . . take-ups . . . friction and jaw clutches, including the famous Twin Disc line . . . cast and cut tooth gears . . . steel split and cast iron pulleys . . . safety collars . . . couplings, both flexible and rigid . . . drop hangers and hanger bearings . . . grease fittings . . . shafting—the latest designs of the leading manufacturer of power transmission equipment. The line that answers every need for dependable, low-cost power transmission service in all industries.

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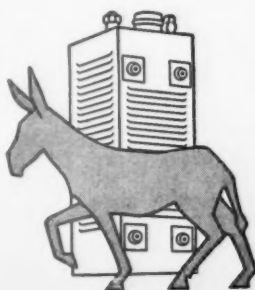


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Then, too, it brings you very practical operating advantages. Good examples: accepts charge rapidly (often a big help in completing charge during off-peak periods); can work hard at high temperatures; stands idle indefinitely without attention, injury or expense; is simple and easy to maintain.



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REDUCE POWER LOSSES WITH CONTINUOUSLY WELDED TRACK

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By eliminating rail joints, and doing away with the need for rail bonds, Thermit welded track can reduce your power losses to a minimum.

Thermit welds have electrical conductivity equal to that of the rail itself. In fact, approximately 20% greater conductivity is obtained in Thermit welded track than in new track bonded in the usual way. And, this high conductivity of Thermit welds is permanent. It remains the same as long as the rail is in service. Power losses can never develop, as they do where there are plates and bonds to corrode and become defective.

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- Increased Rail Life
- Faster Haulage

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Opinions expressed by authors within these pages are their own, and do not necessarily represent those of the American Mining Congress

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THE AMERICAN MINING CONGRESS

309 Munsey Bldg., Washington, D. C.

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JULY, 1939

9

The Neely Bill

ONE more nail in the coffin of constitutional government.

One more step in the destruction of the power of states to control their own internal affairs.

One more repudiation of the contract without which there could have been no consolidation of the separate states of the revolutionary period into a central government.

A dangerous experiment with the nation's mine safety work—which, after 30 years of increasingly successful effort by scientists, humanitarians, operators and miners, all giving enthusiastic cooperation, continues to function more and more effectively under intelligent leadership.

The Neely Bill now being seriously considered by a subcommittee of the Senate Committee on Mines and Mining will, if enacted, authorize the exercise of a vicious form of Federal police power within the several states which could easily develop into a strangle hold on the mining industry.

It would give to the Secretary of the Interior ultimate authority to condemn the equipment of any existing coal mine and to determine what if any machinery may be used. It would give him the power to discipline, at will, any and all mine operators with or without reason. It would make difficult the very wholesome cooperation long evident between mine managers and employees, and between the U. S. Bureau of Mines and the various State Mining Departments. This legislation is asked for the purpose of greater safety in mining operations, and offers as an excuse that the present efforts in this behalf are inefficient.

If this legislation would make for safety in mining operations the writer would give unqualified endorsement.

Safety is not created by force, by investigations or by the exercise of foreign police power. The Neely Bill seeks this through these very methods.

Perhaps no man in the nation has had larger or more successful experience in mine safety than Eugene McAuliffe, president of the Union Pacific Coal Company. Mr. McAuliffe says that "the problem will remain unsolved until the men who suffer the accidents become accident conscious."

In the large operations of his company during the three five-year periods from 1923 to 1937, inclusive, the fatal accidents for each period were 48, 35 and 22, respectively; for the years 1937 and 1938 there were but two fatal accidents each year, and for the first five months of 1939 there was not a single fatality. The number of man hours per fatal accident increased from 15,617 in

1923 to 139,371 in the first five months of 1939.

And why shall this magnificent record be interfered with?

Mr. Herbert S. Salmon, representing the Alabama Mining Institute, gave testimony before the Committee of an equally impressive safety record. The total operations of the state of Alabama show that for the six five-year periods from 1906 to 1935, the fatalities were 725, 643, 507, 591, 432 and 121, respectively.

Mr. Salmon also called attention to the fact that up to June 30, 1938, 58,418 persons in the mineral industries of Alabama had been given first aid training; that 3,921 had been trained in mine rescue work; that 161 mines had been given 100 percent certificates indicating that their entire personnel had received the U. S. Bureau of Mines first aid training course, and that 60 chapters of the Joseph A. Holmes Safety Association had been established.

What a magnificent record, and why shall it be discredited?

In 1907, the year that the writer was sent by the western metal mining industry to Washington to ask Congress to create a Bureau of Mines, the loss of life in the coal mining industry of the United States was 3,242. In 1938 these fatalities were reduced to 1,128, while the fatal accidents per million tons of coal produced had been lowered from 6.78 to 2.92. On the whole a magnificent record. Why disturb it?

Statistics show that more than half of the fatal coal mine accidents are caused by falling roof. Miners are required, not only by operating rules and by contract, but by self interest as well, to test all dangerous indications before subjecting themselves to risk, and to remove the hazard. This hazard, which may develop in an hour, may be reduced by the "accident consciousness of the man who must suffer," but never by periodical inspection by a Federal Authority.

It is hard to reconcile the benevolent pretensions of those who favor this legislation with the confusion, the duplication of effort, the conflicts of authority and the destruction of the friendly cooperation which has served the cause of safety so well. This should be true even to those who believe in the further concentration of power in the Federal Government.

President James Madison in discussing this latter question once asked, "What degree of madness could ever drive the Federal Government to such an extremity?"

And we ask "For what purpose does this big colored gentleman hide in the woodpile?"



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Richard J. Lund, Editor

TOWARD STABILITY IN THE WEST

FINAL passage of the Monetary Bill, which involved such a heated controversy, is an important step in assuring improved conditions throughout the entire western mining area, where silver constitutes an important co-product in the great majority of the mines, and in a sizable number is the metal of principal value.

Of particular interest to mining is the statutory provision for purchase of domestic silver at a fixed seigniorage rate of 45 percent of the \$1.29292 per ounce coinage value, amounting to the payment of 71.11 cents per ounce to domestic producers, without dependence on executive proclamations. As passed, this rate is now permanently binding until changed by congressional action.

Thus, the uncertainty over pending changes in seigniorage rates that has repeatedly faced the mine operator in the past is now considerably mitigated, and he can proceed with development plans with greater confidence in the future. Stability not only of western mining enterprise but also of entire communities dependent thereon is thus made more secure.

A WORTHY STAND

CONFEREES still remain deadlocked on the TVA Amendment Bill. It will be recalled that Senator Norris's bill, passed by the Senate, provided for the authorization of a bond issue of \$100,000,000 to consummate the purchase and rehabilitation of the properties of various power companies operating in the TVA territory, while Congressman May's bill, passed by the House, provided for \$65,000,000 to be expended only in the purchase and rehabilitation of the properties of the Tennessee Electric Power Company, and limited the activities of the TVA—built a fence around it, so to speak.

In the bitter fight against the utilities during the past six years, led by Senator Norris, the serious plight of the coal industry and its half

million workers, although not entirely lost sight of, has not been given the careful attention it justly deserves. Fortunate it is, therefore, that Congressman May has now stepped into the fight and is doing worthy battle against the further displacement of millions of tons of coal and thousands of man-years of employment. The issue is nowhere better outlined than in Congressman May's own statement made June 28 immediately following another meeting of the Conference Committee, of which he is chairman, at which no agreement was reached. He stated in part:

"In other words, the vital question which bars agreement between the House Conferees and Senator Norris . . . is the issue of permitting the Federal Government to establish an industrial empire of public utilities, competitive with privately-owned utilities and covering seven or eight southern states, which empire would ultimately result in state socialism on a national scale. The TVA is the instrument which the state socialists would use to accomplish their ends and the inevitable result would be complete destruction of large tax-paying industries and addition of hundreds of thousands of railroad employes, coal miners and other industrial workers to the bread lines. The country might as well face that issue now. The House of Representatives, by a majority vote of 25, has set forth its position and it is the duty of the House Conferees to maintain that position. . . .

"So far as I am concerned, as Chairman of the House Conferees, when I can save \$35,000,000 for the taxpayers, I shall endeavor to do so. Not only this, but I am making a fight for the preservation of the coal industry, the railroad industry, the electric utilities and their workmen. All of them are labor-employing industries, while the TVA is exclusively a hydro-venture, which means a laborless source of energy."

Another aspect of the utility-busting program has been working quietly behind the scenes to the detriment of the coal interests,—namely, the large number of municipal power plants driven by diesel or hydro power that have been built by the Public Works Administration. Such projects have an ultimate capacity of 5 million kilowatts—almost half of the total installed capacity of hydro-electric generating plants in the United States in 1933. Of a total of 77 allotments for non-federal competitive power projects made from 1938 funds, only four were for plants using coal as a source of power.

This vicious program must be curbed at the earliest possible time if the coal industry is to survive—and Congressman May is to be heartily and sincerely congratulated for the glorious fight he is waging toward this end.

The ENGINEER in the BUSINESS WORLD*

HAVING spent 34 years in the operating, business, and executive divisions of an industry that employs directly and indirectly many engineers, I have attempted to select a subject for today which I feel should be foremost in your mind at this time. The topic I have chosen is "The Engineer in the Business World."

In discussing this subject there are three main thoughts which I consider of primary importance that I wish to leave with you.

First, that the field for engineers in the business world is a varied one from which a young graduate can choose, and that the opportunities in these fields are as great today as they ever were.

Second, that while it is necessary to have a definite scientific goal in mind, it is also necessary to keep abreast of current affairs and to be well informed on matters affecting our social, political and economic structure.

Third, that irrespective of the scientific attitude, success in your chosen field will depend largely upon your industry, native ingenuity, character and personal attributes.

Unfortunately, in the last few years, a number of professional, educational, business and political leaders seem to have come to the conclusion that inasmuch as the territorial frontiers of this country have been settled and developed, opportunities are much more limited today than in the past.

Quite recently I listened to an address by a man of international reputation as an economist and analyst of business conditions. So dark did this gentleman paint the general picture of the future of business and business opportunities that I came away with the unhappy feeling that this man had at least convinced himself that all was lost and that we all might as well throw in the sponge and quit.

Optimistic Over Future Opportunities

I do not subscribe to this thought for one moment. On the other hand,

* An address delivered to the graduating class of The Missouri School of Mines, Rolla, Mo., May 23, 1939.

By HOWARD I. YOUNG

President of the American Zinc, Lead & Smelting Co., of the American Mining Congress and of the American Zinc Institute

I do feel that our present state of development, both socially and industrially, is a challenge to the young engineer to put forth greater effort in helping to develop the many possibilities that still remain undeveloped in practically every line of endeavor.

It is true that we do not need to devote our energies in withstanding the hardships borne by our forefathers, nor can we dream of the "wide open spaces" in the West, North or South, which our fathers and forefathers

helped to develop. There is no question that the developments of that day required men of courage, perseverance and character—traits necessary for the pioneer to survive the hardships that nature forced him to endure. The development of this great country of ours must be credited to the type of men who had these qualities. What our country needs now is a supply of men with the same courage but with keenly trained minds, exact knowledge and skilled fingers to

PRESENTATION OF MR. HOWARD I. YOUNG TO PRESIDENT MIDDLEBUSH FOR DEGREE OF DOCTOR OF ENGINEERING HONORIS CAUSA

"Howard I. Young, eminent engineer and industrialist, for 30 years has been connected with the American Zinc, Lead and Smelting Company, one of the most progressive and integrated mining and smelting companies in the United States. He has rendered distinctive service to the mining, smelting and allied industries through the economic coordination of widely diversified problems, and to the state of Missouri through his development of its mineral resources. Thus he has contributed very largely to the yield of those metals of which this state is a leader—zinc and lead.

"In addition to the outstanding position he occupies as one of the leaders in the mining and metallurgical industry, Mr. Young is in his fifth consecutive year as president of the American Zinc Institute, in his seventh consecutive year as president of the American Mining Congress, is an active member of the American Institute of Mining and Metallurgical Engineers and the Mining and Metallurgical Society of America.

"Although denied the opportunity of a college education in his younger days, his outstanding accomplishments are proof of the natural instinct of the engineering leader. That he has ever been appreciative of the work done by the college-trained engineers has been shown by the great numbers he has brought into his organization.

"For his leadership in and service to not only the zinc industry, but to the mining industry in general, he merits recognition and I have the honor to present to you, Mr. President, Howard I. Young for the Degree of Doctor of Engineering, honoris causa."

transform our natural wealth of raw materials into something tangible, something which will benefit humanity.

I wish to quote from a recent statement made by Charles F. Kettering, vice president in charge of research for General Motors Corporation. Mr. Kettering is, no doubt, one of today's leading authorities on research and its possibilities in this country. He says:

"There never has been a time in the history of the world when we needed inventions as much as we need them now. We are so far behind that I am ashamed of our engineers, scientists, and research laboratories. We know we are far behind because we have many men out of work, a lot of money lying idle in the banks, and an enormous amount of raw materials. When we have these three essentials—men, money, and materials—with nothing for them to do, it can mean only that we are way behind in developing new products to put them to work.

"We need research in every phase of our business to strike the sparks which will rekindle the fires of activity. In the final analysis, it is industry that must and does carry the cultural, governmental, health, and pleasure load of the country. It is industry which must make the first move to launch us on our next great expansion."

I further wish to quote from a statement made within the month by Dr. James K. Hunt, of the du Pont Company in addressing the Economic Club of Chicago. He said:

"In the du Pont Company 12 new lines of products, developed largely since 1929, account for around 40 percent of our total sales. Underlying the development of these new products is a policy of continuing research.

"Scientific research has opened up new avenues of employment for countless thousands through developments that gave birth to new industries. These include the automobile industry, which provides employment, directly or indirectly, for 6,000,000 persons; the radio industry, which has provided about 150,000 new jobs and spent last year more than \$900,000,000."

From these statements, both made by men of high standing and unquestionable ability in their particular companies, it becomes rather hard to agree with those who seem to think that the door has been closed to opportunity and development for all time.

Development in Mining Industry

Within the last few years, all of us have been amazed at the wonderful development in the mining industry. Let us take, for instance, the development of the recovery of molybdenum from copper mines in Utah. This process was worked out by Rolla engineers, and today the Utah Copper Company is the second largest producer of molybdenum in the world. Prior to 1936, only three years ago, no molybdenum was produced at this mine.

Engineers have, through careful research and application of the research results to operation, made available from complex ores a large supply of rare minerals that were not available until the last few years.

Within the last three years in our own company there has been developed, for commercial practice, a new method of concentration which offers possibilities for the more economical handling of low-grade ores and the higher extraction of the mineral content. In this particular development, it has been most interesting to me to observe the high degree of enthusiasm and intelligent effort that the engineers and operators have displayed in carrying the work to its final conclusion.

Other Monuments of Research

In other fields, within the last 10 years, there have been wonderful strides made in the development of plastics for all purposes. The development of rayon and the development of "Nylon" are two examples. The development of "Nylon" has resulted in the spending of approximately \$18,000,000 to construct plants which will be in operation within the next eighteen months producing a silk substitute that has stronger fibre than, and is, in many respects, preferable to, the silk heretofore supplied to this country from the Orient.

Let us consider the development in the automobile industry. Take the Model T Ford which all of us can remember, and compare it with the Ford car of today. The development of this new Ford car has not replaced manpower, as it requires just as many man shifts to produce a Ford automobile as it did when the Model T was being produced. Development in the automobile industry by the automotive engineers, and mechanical and electrical engineers, has given to the public the most value for its dollar that can be obtained from any one article in this country.

Also, consider for a moment the development in the field of radio. You all can well remember only a few years ago when it was difficult to pick up any station, even here in Rolla. Today we can drive along the highways 50 miles an hour and tune in not only our local stations, but stations all over the world. Another example of the product of our engineers.

Development in streamlined train equipment, aviation, air-conditioning, television and a number of important



HOWARD I. YOUNG

developments in other lines has taken place within the last few years.

Over 100 years ago the head of the United States Patent Department reported to his chief that in his opinion practically all of the things that were going to be patented had already been thought of and patented, and it would not be necessary to consider increasing an appropriation for providing more room and staff to handle that department.

Today we smile when we hear this statement, for we realize the lack of foresight and vision this gentleman must have had. "Everything can be improved," says Mr. C. W. Barron. Mr. J. Ogden Armour adds, "Whoever admits that he cannot improve his methods has acknowledged himself to be at the end of his rope, and that is always the saddest predicament which anyone can get into."

Intelligent, Courageous Management and Capital Also Needed

In considering these developments, we should not overlook the fact that in addition to the technical and operating skill absolutely necessary in the development of every one of the ideas I have mentioned, it was necessary to have back of that idea intelligent and courageous management, as well as capital. Very often management has urged its technical divisions to continue research work on a certain line when the results up to that date had been most discouraging, and, as a result of this type of courageous management, we have developed and are developing the products that have made the standard of living in the United States the highest in the world.

You should not overlook the fact that in order to have back of you the essentials which are necessary to de-

velop the industrial frontiers as they should be developed, there must be incentive, not only for the engineers and the workmen, but also for the investors and management who are required to make these things possible. You, as citizens in your respective communities, should feel the obligation to help formulate those ideas and plans that will continue to make this country not only proud of its standard of living but also to maintain those principles which have been so necessary and are now so essential for our further development.

High Living Standards Not Fully Appreciated

Few people fully appreciate our comparatively high standard of living, particularly as it refers to those so-called necessities formerly classified luxuries. For instance: America has approximately one-fifteenth of the population of the world. We have in our homes and offices approximately 50 percent of the telephones of the world. One out of every five people owns an automobile, while in France there is only one for every 22 people; in England, one for 23 people; and in Italy, one for 109 of the population.

As an example of the progress that has been made in this country between the years 1900 and 1938, it is interesting to note that the total number of automobiles has increased from 8,000 to approximately 25,000,000. In 1900 there were no trucks—now there are approximately 4,250,000. Tractors on the farm were not heard of—today we have 1½ million.

At the annual exhibits of mining equipment in connection with the coal and metal mining conventions held under the auspices of the American Mining Congress, it is always interesting to note the technical development in various types of underground mining and surface concentrating and metallurgical equipment, all of which are the direct combined effort of the mining, mechanical, electrical and chemical engineers in cooperation with management. This progress has been and is absolutely essential in coal and other industries in order that production can be obtained at cost so that the finished product is kept sufficiently low to meet competitive prices.

Thirty-eight years ago there were no homes wired for electricity in this country—today we have 23 million. There were no radios—today we have 26½ million; no electric cleaners or electric refrigerators, and today we

have about 11 million of each, and approximately two million electric ranges. Most of these items, which we now consider essential, are the result of the intelligent and well-directed efforts of the engineers in the development of the products and the directing of the operation to produce them at a low enough cost to meet the average American pocketbook.

I have presented to you some of the scientific developments which have been made within the past few decades. I believe that the scientific developments in the next 20 years will be as great as or greater than they have in the past 20. This is a challenge to the young engineer and, therefore, with these opportunities before you, you can very readily appreciate why I am optimistic and hopeful for your future.

While it is true you are today receiving your diploma showing that you have mastered the different subjects studied during your college course, you must remember that what you have learned thus far is merely the foundation for your career. Those of you who have, during the vacation periods or at some other time, worked in some particular line of industry, appreciate that you still have much to learn, and therefore realize the necessity of continuing to study. Your training will be a great asset to you in properly directing the lines of research study that you will continue for many years, in order to become thoroughly familiar with all the aspects of the particular line of industry in which you are engaged. It is not only necessary that you continue to study on the technical problems and their related subjects, but if you are going to properly fill your place in your community, you must keep abreast of all of the current affairs by studying domestic and world economics, and social and political problems.

Broader Subjects and Problems Should Be Mastered

Know what is going on in the vast world outside your own particular sphere. Find out all you can about what others are doing. Keep yourself well informed. The specialist knows everything about one thing. The intelligent man of today attempts to know all he can about his own business and something about every other important subject, too.

Many opportunities exist for engineers in lines of business where most people never think of using men of technical training. An engineering

education fits one to analyze and evaluate carefully the major factors in most lines of business.

Engineers in Key Positions

Today we have as the heads of some of our largest financial institutions men who were formerly mining or mechanical engineers. I have in mind particularly the chairman of the board of the Guaranty Trust Company, William C. Potter, who, for a number of years, was a mining engineer with the Guggenheim interests. Friends of mine in the insurance business have from time to time made inquiry as to where they could find young men with engineering training who had the proper personality to enter selling organizations. In the selling end of most lines of business today, engineering is quite essential, and the position of sales engineer is, in many companies, one of the key jobs.

While it is true today we have a large number of unemployed and hear a great deal said about unemployment, it is my firm conviction that almost any young man with the training you have, and with the proper personality for the position he is seeking, will have no trouble in finding work, provided he is willing to start in such capacity as the employer is in a position to offer.

Starting at the Bottom

No doubt many of you have fixed ideas as to the type of work that you wish to have when you start out next week to look for employment. On this point I want to give you a little friendly advice. It is important that when you have decided on the type of industry you would like to cast your lot with, that you then try to locate with a company which you know has progressive management, and then take any type of job that they have to offer. Usually when our company hires engineers (and we try to start several young men each year) we endeavor to select promising young men who are willing to start work in the mine at mucking or helping on a machine. We realize fully that if this man has the proper qualifications, it will only be a comparatively short time until he has developed sufficient knowledge of the work, and will have demonstrated his ability to handle men so that he can take a job as sub-foreman or foreman.

Although the money you make is of importance, remember that doing what you like to do, with the kind of people you like to work for, is even more important to your happiness. William

Allen White once said, "We are apt to say that money talks, but it speaks a broken, poverty-stricken language. Hearts talk better." And happiness and a feeling of accomplishment should be your first consideration. Money will come in time. Harry B. Thayer put the thought very well when he said:

"Forget yourself in your work. If your employer sees that you are more concerned about your interests than about his, that you are fussy about getting credit for every little or big thing you do, then you are apt to be passed by when a responsible job is to be filled. . . . Don't worry about how big an increase in your salary you can contrive to get. Don't let your mind dwell on money at all if you can help it. Throw yourself, body, soul, and spirit, into whatever you are doing. . . . The truth is that in every organization, no matter how large or how small, someone is taking notice of any employee who shows special ability."

Very often you will be transferred from one department to another, thereby giving you an opportunity to learn all steps of the operation. It is important that while you are in these minor positions you make a careful study, not only of the best way to handle the work, but also get as much information as you can. Become well acquainted with your fellow workmen, as these are the type of men you will be expected to manage as you step up the ladder, and you can learn something of value from them all. Sometimes advancement from these minor positions may seem slow to you, but usually the slowness is due to the small turnover in the directing staff of the particular business in which you are engaged.

Ask Intelligent Questions

When a company hires a young man it expects to make an investment of several thousand dollars before it will know whether or not he has the qualities to prove to be a real asset to the organization. They are anxious for you to learn as fast as possible, and, therefore, they are, in most cases, ready and willing to answer any questions that you might wish to ask relative to the business.

Never be afraid to ask intelligent questions. "Why" and "How" are such useful questions that they cannot be uttered too often.

Keep an open and inquisitive mind, and try to learn something new either from your fellow workmen or some foreman or departmental head each day. The management is always on the lookout for an industrious and intelligent worker who demonstrates in the efficient handling of each task as-

signed him his adeptness and ability to master his job. Each task assigned you is a test of your efficiency.

Only recently a young man in our organization came to me and asked to be permitted to study records of our properties other than those with which he was directly connected. I was most happy to make all of our records available to him, as would be the case with the majority of management. However, it occurred to me that so few men are willing to exert the extra effort to better themselves, to make themselves ready for additional responsibility. Owen D. Young once said:

"There is a single reason why 99 out of 100 average business men never become leaders. That is their unwillingness to pay the price of responsibility. By the price of responsibility I mean hard driving, continual work . . . the courage to make decisions and to stand the gaff . . . the scourging honesty of never fooling yourself about yourself. You travel the road to leadership heavy laden. While the 9-to-5 worker takes his ease, you are toiling upward through the night. Laboriously you extend your mental frontiers. Any new effort, the psychologists say, wears a new groove in the brain, and the grooves that lead to the heights are not made between 9 and 5, they are burned in by midnight oil."

No doubt many of the points I have already mentioned have been brought to your attention frequently during the past four years by your instructors and some by your observations in actual contact in various lines of business.

Development of Personality and Character

The third and main thought that I would like to leave with you is one that cannot be too often repeated, and one that you should take to heart—the development of personality and character. During your years at school you have spent much time in learning the subject matter of your various courses. I may be wrong, but I doubt very much if your courses of study included anything relative to your proper attitude toward fellow workers, or a course on teamwork, or on fairness to others and yourself. Naturally, in your activities and associations it has been necessary for you to live in harmony with your fellow students or to be left alone.

Some people are born with the knack of getting along, and without any special effort can adapt and adjust themselves to any condition. Happy, indeed, is the man who, by nature, is so blessed. It is so often true that one who has become deeply engrossed in his desire for technical knowledge overlooks the necessity of developing personal mannerisms and traits that

will be of much value to him in his contacts and handling of people in the business world. Fortunately for those of us who were not born with gracious dispositions and winning manners, it is possible to acquire some of these personal traits, or at least conduct ourselves in such a manner as to merit respect and cooperation.

Value of Cooperative Spirit

Personality can be developed. A fine cooperative spirit is necessary in any business organization if it is to attain efficiency in plant operation and low cost production. Those of you who have taken part in college athletics realize the full importance of teamwork. You know how the success of the team depends on the proper coordination and cooperative effort of all. In business this is just as important for success as it is in football, baseball or any other game.

It is true there are all kinds of personalities in all professions, but I do believe that even though one does not naturally have the knack or desire to cooperate with his fellow workmen, that he can, by a determined effort, develop his personality and habits so as to properly fit into any organization.

Management is continually on the lookout for trained young men, such as you, who are industrious, honest, ambitious, and who have the personality and the ability to work with men. I have seen in organizations the unfortunate high cost brought about by just a few individuals who will not make the effort properly to cooperate with the policies and purposes of those with whom they are working.

An instance recently came to my attention where a young man, who was an exceptionally good engineer and who was capably discharging his duties, was, for some reason, unable to cooperate with his immediate superior. Unless this man changes his ideas and attitude, he will probably advance no further in his organization. He possesses all of the technical ability and every qualification except the ability to cooperate.

Importance of Being Good Human Engineer

While dealing with this subject I want to bring to your attention the necessity of your developing the ability to deal with your fellow employees. In the last 10 years much has been written and said on this subject.

Our new Federal laws have put the employer at a decided disadvantage in

a number of ways. Today, as never before, one must have the personality and training to inspire the confidence of those over whom he has supervision, as well as those with whom he is working, so that there can be frank discussions of the problems that are today of such vital importance to the successful operation of all lines of industry.

As you are given responsibility, naturally, in most instances, you will become the manager of men. Today, the demand for men who have the ability to keep all departments of an organization working smoothly and harmoniously is much greater than the supply.

You have a wonderful opportunity, as you start to work, to study and analyze the men with whom you are working. Understand and have a sympathetic attitude toward their problems. There is nothing that inspires confidence in your fellow employe any more than the ability to consider carefully his side of the question, and then to render a fair and unbiased decision.

Mr. Charles R. Hook, president of American Rolling Mills, recently said: "The great need today of our social, economical and political life is understanding. It has always been so, but today the need is greater than ever."

Human engineering is a very important field. The immortal Will Rogers said: "It's great to be great, but its greater to be human."

Maintain High Standard of Ethics

Unfortunately, in the last few years, unethical practices of a comparatively few business leaders have caused a large number of men in responsible positions to be regarded with suspicion. Individuals who are responsible for these bad and unethical practices are those who fail to have proper strength of character and determination to conduct business on the proper ethical plane.

Basic honesty is without substitute. Every right-thinking American knows this; most of them practice it. As a result, American business is not the corrupt institution that radicals sometimes like to picture it. There is no sound basis upon which it may be assumed that all poor men are godly and all rich men are evil, no more than it can be assumed that all rich men are good and all poor men bad.

There has never been a time in American business or in American leadership when the demand and need for trained men of sterling character was so much to be desired as at present. The building of character and

personality is a daily job, and we should all take inventory frequently.

The successful man develops the art of seeing himself as he really is, of seeing others as they really are, and dealing with them in such an understanding manner that every relation with people is mutually pleasant and beneficial.

In closing may I leave with you the 10 pointers of Dean Everett W. Lord. They are worth while remembering.

1. Be yourself. Cultivate desirable qualities.
2. Be alert. Look for opportunities to express yourself.
3. Be positive. Determine your goal and the route to it.
4. Be systematic. Take one step at a time.
5. Be persistent. Hold to your course.
6. Be a worker. Work your brain more than your body.
7. Be a student. Know your job.
8. Be fair. Treat the other man as you would be treated.
9. Be temperate. Avoid excess in anything.
10. Be confident. Have faith that cannot be weakened.

"Liquid Coal" Propels Automobile

Exhibiting the startling possibilities of their newest development, "Liquid Coal," scientists of the Research Foundation of Armour Institute of Technology recently showed how it was possible to operate and drive a 1939 stock model automobile (Pontiac 8-cylinder sedan), on coal. This newest development in research goes to the credit of Dr. Francis W. Godwin, Director of the Coal Research Division of the Research Foundation of Armour Institute of Technology. The demonstration took place on Randolph Street in front of the Sherman Hotel and was witnessed by a delegation of pressmen, scientists, and coal dealers and producers attending the American Retail Coal Convention and Exposition held at the Sherman.

The most amazing part of the entire demonstration is found in the fact that the test with coal was made on a standard car engine without any changes of any kind in carburetion or in the ignition system of the motor, with the exception of the removal of one fine-screen filter.

"Liquid coal," or colloidal fuel as it is more commonly known to research engineers and scientists, is undergoing development by Dr. Godwin of the Research Foundation staff. It will be remembered that Dr. Godwin is one of the two scientists who perfected the high-speed photography equipment

developed at the Research Foundation for the taking of pictures at the extreme speed of one-millionth of a second exposure.

According to Dr. Godwin, three different types of colloidal fuel have been used successfully in the tests on the stock model automobile to date. The first of these fuels was a suspension of a specially prepared coal, ground to 300-mesh in a mixture of gasoline, fuel oil, and lubricating oil. The second test with the "liquid coal" was made with a suspension of the coal in Diesel oil. The third test was made with a suspension of the coal in a very light oil. The most recent test and demonstration was carried out with a more elaborate preparation of the fuel. A very light oil, or a form of range oil with a light fraction of hydrocarbon was used as the vehicle, followed by special treatment with the coal, resulting in the suspension of coal of about 500-mesh. In each case, before the "liquid coal" was introduced into the auxiliary fuel tank on the automobile, it was chemically stabilized in order to hold the coal in suspension.

After the "liquid coal" had been prepared according to the process developed by the scientists, it was introduced into the auxiliary fuel tank. The automobile was then started on gasoline and, after smooth running

conditions had been attained and the motor had "come up to driving heat," the fuel system was changed so that the gasoline supply was cut off and the "liquid coal" introduced in the carburetor. Thereafter the engine ran on "liquid coal."

In order to determine whether the new fuel reacted properly, so far as actual driving of the automobile was concerned, Dr. Godwin then stepped into the driver's seat and drove off with much the same dispatch and smoothness boasted of by the manufacturers. In previous demonstrations Dr. Godwin has been able, in second gear, to bring the car up to a speed of 35 miles per hour in the space of one block without any undue strain or sluggishness.

Although "liquid coal" is not a product that is ready for the market or, more specifically, ready for consumer use in automobiles, the possibilities as shown by the demonstration are great. "At the present time," said Dr. Godwin, in conclusion, "we have about a year's fundamental research work to do on 'liquid coal' before it will be ready for the market. The work, up to the present time, of course, has been carried on by the Foundation as a fundamental research project. Our next step will be to continue on the developmental research basis—work which we expect will be finished in about one year."

What This Age of ELECTRIC POWER Has Meant to the MINING INDUSTRY

IT IS difficult to think of cheap and readily available electric power without thinking also of mechanization—each is such an important part of the other so far as the mining industry is concerned. Generally speaking, however, electrification or, if you will, mechanization has lowered costs at the mine face; it has bettered working conditions and helped to increase wages per working day; and to some extent it has improved distribution. In turn, the mining industry—through mechanization—can supply its industrial customers with raw materials faster—in greater quantities, and at a lower price.

That is the broad picture of what inexpensive electric power and the machines to utilize it have meant to the industry as a whole. There are also other benefits, perhaps not so obvious, to be found upon studying individually metal and nonmetallic mining. But in making such a study, it is not enough to ascertain the benefits accruing directly to mine operators through the mechanization of mining equipment. It is just as important to study the effects which the mechanization of *all* industry has had upon mining. Our industrial history shows clearly that the expansion of productive capacity through the improvement of production equipment in one industry brings about a similar expansion and similar benefits in all associated industries.

Cheaper Metal Means Wider Uses

In the metal-mining industry it is a simple matter to trace the effects that over-all industrial mechanization has had. Modern high-speed production machinery—almost all of it electrified—such as the continuous strip mill, automatic machine tools of all descriptions, mechanized material-handling apparatus, have all combined to lower the purchasing price of the products of industry to a point where the great mass of our people can afford to buy them. And these mechanized tools of industry have made and are continuing to make possible the use of metal in products where it has not

been used before. In turn, this widening of the market for the metal products of industry has meant more and more ore to be produced at the mine face. It has meant also the inevitable mechanization of the metal-mining industry.

But what of that other great branch of the mining industry—coal mining? What are the benefits that mechanization, both within the industry and without, has brought to the operator and his employees?

Consider first this paradoxical fact which is concerned with an improvement made outside of the industry. In 1882, when Thomas A. Edison started his first generating station, 10 pounds of coal were required to generate one kilowatt-hour of electricity. Today, modern turbine-generators have produced a kilowatt-hour for each pound of coal burned.

Coal Maintains Competitive Position Through Improved Turbine Efficiencies

Has this increase in turbine efficiency hurt the coal operator? To the contrary—and here is where the paradox comes in—whether he has stopped to think of it or not, it has been a distinct benefit because of the fact that through turbine improvement, coal can generate electricity so cheaply. This is the prime reason that coal has held its place as the leading medium for the generation of electric power. Even today, despite vast hydroelectric projects, steam produced by coal is still the principal medium for the generation of electricity in almost all centers where the power load is heaviest. And this is true because of the fact that the average steam plant today consumes less coal in a year than the most efficient one did 20 years ago. The increase in turbine efficiency has made it possible for coal-burning plants to stay in competition with other means of generating power and predominate that field.

Moreover, according to reliable surveys, the market for electric power is far from being saturated. Less than

50 percent of American homes and farms have refrigerators, vacuum cleaners, and electric clocks; less than 25 percent have waffle irons or heating pads; less than 10 percent have electric ranges or ironers.

As the load on power lines increases through the use of more and more electric appliances, so the need for more generating capacity will increase also. And more generating capacity means an opportunity for more steam plants with a corresponding increase in coal consumption.

But what of mechanization within the coal-mining industry itself? Certainly it has bettered working conditions, made possible higher working day wages, and increased production. These are facts and it is this last fact that sums up the most vital problem facing the industry today. Modern coal-mining machinery has given operators enough potential capacity so that, if all mines worked steadily, they would in approximately half-a-year produce enough coal to meet a year's demand. Or, saying it another way, coal production is now twice as efficient as coal distribution.

To some extent this problem is one that faces every industry periodically, and will continue to face industry so long as we progress industrially. But in the words of J. E. Tobey, manager of the Fuel Engineering Division of Appalachian Coals, Inc., there is an answer to the problem. Said Mr. Tobey in a recent address before the Michigan Retail Coal Merchants' Association:

"The only thing wrong with the industry today is that we dig coal faster than we burn it. The solution is simple—either dig it slower or burn it faster. Coal men should strive to burn it faster by finding new customers and by supporting research to discover new uses and outlets."

By H. C. RITCHIE

Industrial Department
General Electric Co.

IMPORTANT FACTORS in Planning a MECHANIZATION PROGRAM

By Jeffrey Mfg. Co.
Goodman Mfg. Co.
Gardner-Denver Co.

The APPROACH to MECHANIZATION for the Hand-Loading Mine

HOW much is a day's work? The mine boss can answer that question, specifically—for every one of his men. A normal day's work in a coal mine is something determined by custom, by the normal "turn" of the cars, by the number of diggers that a driver or gathering crew can serve. But suppose that a radical change establishes a new routine, then who can say what is a day's work! This time the proper answer demands a detailed knowledge of the job. The boss who has actually done the job can answer for the jobs he knows. He has to make a good guess about the others.

Some men representing management, and some laborers, believe that mechanization is a menace, a sinister force designed to make a man work harder. It is a menace to competitive fuels and other sources of power, to inefficiency and to archaic methods. It does

By **EDWIN H. JOHNSON**
Mgr. of Sales
Loading Machine Division
The Jeffrey Mfg. Co.

make the boss work harder, with his brain. For the worker, the new machines make the work enough easier so the men can produce more tons with less effort. The best paid, best treated, most regularly employed and the happiest coal miners are those in mechanized mines. The only man left "in the crack" is the boss.

A statement I frequently hear is one quite generally believed but often untrue—"The older man will never succeed in bossing a mechanical section." Some men of all ages are stubborn, resistant to change, jealous of their own notions and afraid of new ideas. This attitude is neither a matter of age nor of education but a mental

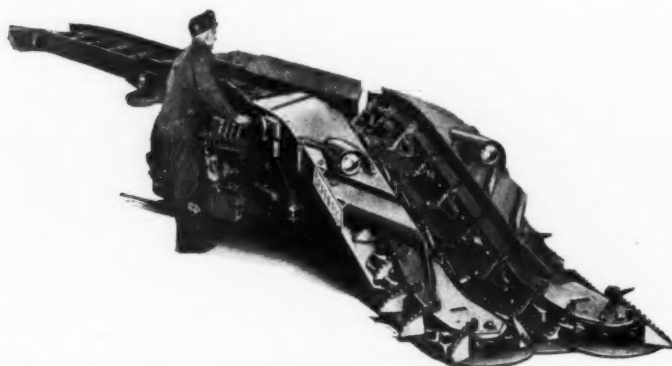
characteristic or trait, which will quite certainly keep such men out of step with progress. Physical agility is less a factor in machine than in hand methods. Mental resourcefulness backed by experience and sound judgment quite often favors the older man.

The successful choice of equipment to modernize a mine, new or old, must be measured primarily by one scale, the yardstick of man day tonnage. The improvement in man day tonnage is the best measure of success. There may be several successful solutions but the degree of success will depend upon the accuracy shown in the selection.

Physical Conditions Control Methods and Equipment

A few years ago some operators, reasoning more from hope than logic, sought to find short-cut answers to lower cost through radical changes in the mining system. The result was partial success in spots, failure in most cases, and grief in large doses for the manufacturers of equipment. The nature of the roof and the physical characteristics of the coal seam effectively do their own dictating of the mining system successfully employed. Loaders and conveyors, through concentration of production, may exert a favorable result in higher recovery and safer roof conditions, but the equipment must be adapted first to the physical conditions that nature provides. These physical conditions together with the existing equipment and live workings are the base line from which the management must aim at a proper man tonnage and a salable product.

Every job between the solid coal and the main line haulage must be analyzed in the study of the new plan. For example, take the timberman. Can the timberman working in a smaller territory do his work enough easier so that he can set props for more tons without hurrying? What safety value has a prop that is set in a hurry, anyway? Possibly he can, especially if you give him posts of the right length,



L-400 loader



29-U universal cutter

provide him with sawed cap pieces and give him timber jacks and post pullers. It will help if you unload his timber nearer to where it is needed. How much quicker could he set a sawed cross bar than a round one? Maybe the difference would justify the extra cost. Most emphatically the effect of trying to get more work done by hurrying the timberman or anybody else in the crew is the worst mistake in mechanization.

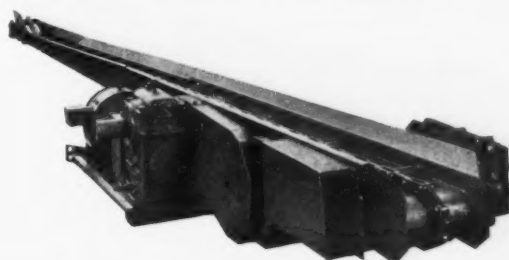
Importance of Time Studies

A similar line of questioning can be suggested for the drilling, cutting, blasting, track-laying, loading and gathering of the coal. These individual jobs have to be studied. And the true picture is obtainable just one way—with a stop watch. When these reports are completed and summarized they should not be filed away, but repeatedly dragged out until they are dog-eared and threadbare and the meat in them all digested.

Recently I asked a very successful superintendent, "How many 40-pound switches will two men lay for you in a day?" "They will lay two, and take out two in a shift with no material carried," was his prompt answer. His time study man had got that answer

for him, and a lot of careful organization was getting those results for him. The same man spent three hours with me in one section of his mine where the routine was not clicking properly. Later I told him the voltage appeared low and the loader sluggish. He remarked that the loading seemed slow, but he thought the coal was too tight. Together we examined a time study report made that day in that section. The fault was all in a slow car change neither of us noticed. The eyes of

Type 61-AM sectional chain conveyor for room work



the stop watch were better than ours.

Why was the car change slow? It developed that the switches were too far back. Why? The track material was unloaded at the wrong place and had to be handled again. Only a time study can locate a sore spot and cauterize it.

The suggestions above touch briefly on a fertile field for cultivation by the mine engineering corps of the coal company. These men can most readily develop this detailed information for the local mine conditions.

Another man called upon for added responsibility is the master mechanic, machine boss or mine electrician. The maintenance of loaders and conveyors in a smooth operating cycle writes a new chapter in organization for the modern mine. The maintenance crew serves two functions: to make repairs quickly, and to anticipate and thus prevent breakdowns from happening. They have to learn that a bad splice may mean a \$4 delay. In a hand-loading mine a power interruption means nothing to a hand loader, a rest to the coal cutter and a headache to the electrician. In a mechanized mine it may mean a loss of \$2 a min-

ute. Good power, good oil, reliable parts, good workmanship, thorough inspection; all these things become vital factors in a mechanized mine. Good teamwork, good planning, adherence to safe mining practice; these test the caliber of the supervision.

The rewards are great.

ADVANCES in MECHANIZATION, INCLUDING SPECIALIZED MINING

TO MOVE large tonnages of bulk material, it seems desirable in our present situation to divorce ourselves from elemental processes, i.e., the man with a shovel and pick. In the so-called modern age in which we live it does appear to be an anachronism to expect to hope that a strong back and a banjo can keep pace with horsepower. Energy, as we envision it, is produced by efficient units, and is therefore relatively cheap. When it is possible to buy horsepower at the rate of 1 or 2 cents per horsepower, it does seem irrational to try and pro-

By **T. E. PRAY**
Consulting Engineer
Goodman Manufacturing Co.

duce at the ruinous rate that is called "man labor."

According to the various experiments conducted by scientists, a man can produce in energy about one-tenth of a horsepower per day. If this is resolved into units of energy, the cost is abnormal. Two cents for a power-produced horsepower, \$6 for a manual-produced one-tenth horsepower. It is

quite evident that the comparison is not within the realm of reasonable relationship. And so let us take a problem that is specific. A problem into which we can inject the fact that horsepower or energy can be applied that will be effective.

Use of Conveyors in Modernizing

To effectively apply mechanics to a coal seam, let us view the limitations which are 40 in. to 60 in. of thickness. Below 40 in. in height, a man requires about as much energy to pull himself around as he has left to perform useful work. If that is so, then it appears unwise to put him in a situation where his already limited energy is further curtailed. So, in working seams that vary within the limits specified, we



Type A-3-B
automatic duckbill
at the face

can find equipment that is at once adaptable and competent. Such may be found in a shaker conveyor with a digging head, ordinarily called a duckbill. This apparatus, in conjunction with a cutting machine, furnish within a degree the energy requirements necessary for a commendable output per man. In other words, a relatively large production per human unit employed without, of course, providing hardship conditions.

The equipment required for an operation of this nature is as follows:

1. A machine to cut the coal where necessary and one that is powerful and effective.
2. A drilling machine of the same character.
3. The shaking conveyor equipped with a digging head with large capacity.
4. A ventilating unit capable of clearing the air after the shots.
5. What is called a "mother" conveyor situated on the butt entry so the coal may be carried to the main haulage way cheaply and expeditiously. The mother conveyor, of course, must be of such capacity as is adequate to handle the output of four or five rooms, because it cannot be predicted with any certainty how many rooms will be discharging coal at any one time.
6. A capable hoist should be provided to move empty trips under

the discharge end of the mother conveyor. The trips should consist of an economical number of cars of the largest capacity the mine conditions will permit.

The ventilating equipment must be installed in order to clear the air at the earliest moment, for in operations of this nature the sequence and continuity are of the utmost importance.

Evolution of the productive capacity of this equipment has been rapid in a short period. Installations equipped with three conveyors with pan line and with an automatic duckbill, all three units feeding into a mother conveyor to a central loading point, have produced an average of 28 tons of coal per man, including timberman and supervision, these installations being in a seam of coal about 5 ft. in thickness. Tonnages of this size per human unit make a reasonable showing on the side of economy.

Specialized Mining

As the extraction of coal from bituminous mines has proceeded over a period of time, the cleaner seams as well as those of reasonable working height have been partially exhausted, making necessary the working of seams that are of good quality but are not high. Also, seams that are of a comfortable working height but are stratified by bands of impurities located at varying positions in the seam.

In order to produce coal at a reason-

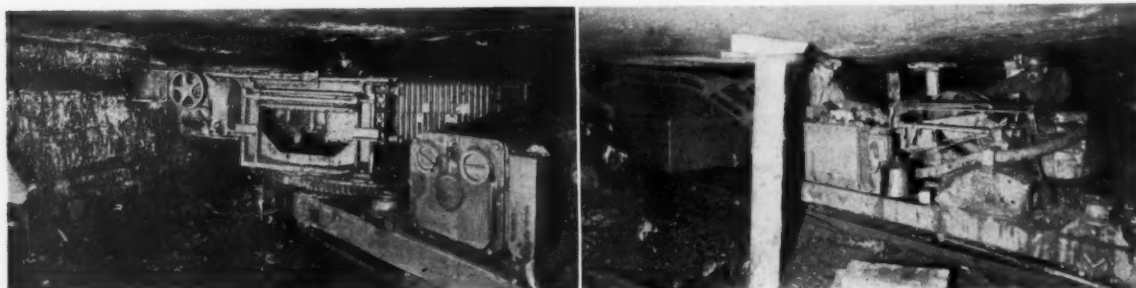
able reduction in cost from seams of the latter description, it has appeared desirable to devise different methods of operation than were previously followed under the cleaner conditions.

With this view in mind, it is desirable to select a specific condition, incorporating a band of impurities. As an example, consider a seam of coal of the following characteristics:

Beginning at the top, there is a band of gas coal 24 in. thick, underlain by impure strata consisting of 6 in. of bone, 4 in. of low-grade coal and 2 in. of slate. This band, in turn, is underlain by 40 in. of splint coal.

Thus, in a seam of this nature there are two grades of coal, separated by a band of impurities. It is then determined that each grade of coal should be removed separately from the face with, of course, the elimination of the impurities from either portion of the coal.

In canvassing the machinery market, it is discovered that machinery for economical operation of this kind has already been developed and will fit the conditions as outlined. The first operation is removing of the top band of gas coal 24 in. thick. We find that this can be done with a machine called a "gobber." This machine enters the room, and with one swing of the cutter bar will remove in its entirety the gas coal, placing it in the mine car without the coal being touched by hand. After this operation is completed the height of the cutter bar is adjusted to attack the band of impurities. This band of impurities is then cut out at one swing of the cutter bar and deposited in the gob space, thus leaving the 40 in. of splint coal practically clean and ready for drilling and shooting in order to be handled by a mechanical loading machine. This drilling and shooting applied to the splint coal is the only operation of its kind, as the gobbing machine, in removing the gas coal and



Type 724 gobber. Left—cutting end, and right—conveyor end

impurities, requires neither drilling nor shooting.

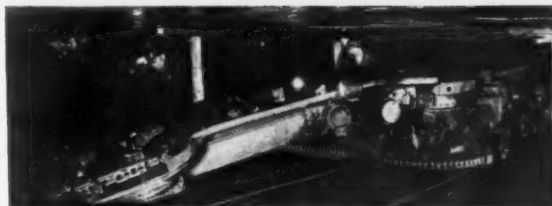
It may also be noted that the coal is cleaned at the face, making the hauling of refuse from the mine unnecessary except within to a small degree. This small amount of refuse that probably would be hauled from the mine would be occasioned by some entry work and room necks where there is no room for gob storage.

A Method of Mining Thin Seams

As an example of a thin seam of coal and the application of machinery to its working, it is practical to use exactly the same type of machinery as is described above. By a thin seam of coal is meant one which is less than 40 in. thick down to one that is about 24 in. in thickness.

Seams of these thicknesses place a tremendous physical handicap upon the workmen. They also make very expensive the handling of the necessary supplies for working the mine.

Type 360
track loader
at work



These two features are estimated to be of such relative importance that the practical thing seems to be to make mines of this description big enough to handle large and competent machinery.

In order to do this successfully, practically 3 ft. of bottom should be lifted for a width of 12 ft. This will not only permit the machinery working in the mine, but the operators may stand up and work in a comfortable and efficient position. Also, which is a very important factor in mechanization, the cars can be of large capacity, practically $3\frac{1}{2}$ to 4 tons. In a mine of this description the gobbing machine will remove the entire

seam of coal, placing it in the cars, without requiring hand labor of any description. The loading machine would pick up the bottom rock, which had been thoroughly shot, and place it in the gob space provided for it. In connection with this system, besides the two pieces of equipment mentioned, it would also be necessary to have a portable compressor outfit of good capacity equipped with jack hammers.

Both of the specialized mining operations described above are somewhat unorthodox, but are practical. However, they do call for considerable educational work to be done with the mine personnel.

Factors to Consider in Planning Use of MECHANICAL LOADERS

IN CONSIDERING the use of mechanical car loaders, it may be accepted as fact that they are faster and more economical than hand shovelling. The considerations involved, therefore, have to do with the mechanical equipment of the mine, the economic aspects of loader use and the operating methods of the mine.

The mechanical factors include the size of headings, the track gauge, the size of cage, the ore cars in use and the air supply.

The size loader in most general use will clean up headings ranging from 5 ft. by 7 ft. to 8 ft. by 10 ft. In metal mining, headings outside of this range are the exception.

Track gauges from 18 in. to 30 in. can be accommodated by minor changes at the factory before shipment. A few of the standard size loaders have been remodeled to operate on 36-in. gauge track with satisfactory results. Preferably, 12-lb. rail or heavier should be used.

If the cage is too small, the loader usually may be partially disassembled for lowering into the mine. If this is necessary, it is a handicap, as the

loader might otherwise be used to advantage in several headings on different levels.

The loader can be equipped for almost any ore car in general use. Cars varying from 14 to 55 cu. ft. capacity can be handled, and the manufacturer will supply a coupling to suit the car. In a few instances mine cars are found with unusually high sides which would necessitate carrying higher headings so the loader bucket will clear the back and at the same time clear the car. Cutting the height of the car-ends sometimes obviates this necessity. Where it has been necessary to increase the height of the heading to accommodate a loader arranged for a high car, the resultant ability to drill and pull a deeper round in combination with the increase in mucking speed due to the use of the loader, have offset the added cost of handling the additional muck.

New air lines are unnecessary since

By R. H. PEARSON
Gardner-Denver Co.

the loader will operate satisfactorily from the existing air lines which supply the drills. Air consumption of a loader may be considered as about equivalent to that of a 3-in. drifting drill.



One type of loader proving popular in mechanical mucking

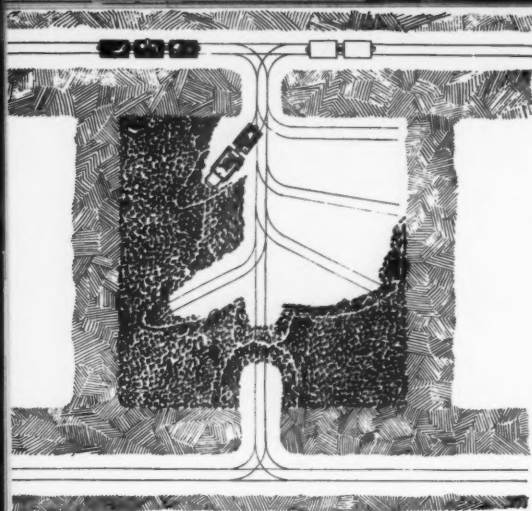


Fig. 1. Loaders are used not only in tunnel driving but in opening wide stopes in some operations

The economic aspects of loader installation may be brought out to the best advantage by citing typical comparisons with hand-loading methods.

In drift loading, time and labor savings with the mechanical loader are appreciable. Even in competition with cheap hand labor in some of the large mines of South America, where the ability of the loader to compete with the low-cost hand methods was considered doubtful, a trial installation soon proved clearly that the mechanical loader could compete successfully and had the added advantage of increased speed.

As a specific instance, in one large property in South America, three natives would clean up the muck of a standard 7 ft. by 7 ft. drift round, consisting of 26 to 28 tons, in an 8-hour shift. The mechanical loader cleaned up six similar headings in two shifts' operation and is regularly aver-

aging five of these headings in two shifts. The loader crew consists of two men—operator and helper. In other words, the mechanical loader is disposing of two and a half times the muck per shift and with one less man.

Versatility Permits Application to Special Conditions

Although generally used for drift and crosscut headings, there is a noticeable tendency on the part of operators to adapt their mining methods to loader requirements and to take advantage of its versatility by using it under special conditions.

One operator uses several loaders on

loader, digging its way through the opening, works continuously until the stope chamber is cleared (see Fig. 1).

Another mine found it advisable to bring certain new ore bodies into production as quickly as possible in order to keep the mill up to capacity. From the ends of short turnouts which were staggered on either side of the drift, raises were driven into the ore which was then stoped out and allowed to run down into the blind end of the turnouts. The loader is moved from one opening to another and kept in continuous operation throughout the shift. Although costing more than drawing out of chutes, the delay of building the chutes, their maintenance

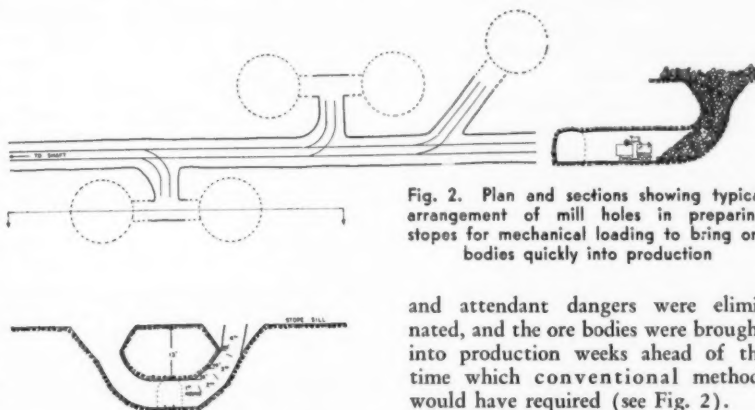


Fig. 2. Plan and sections showing typical arrangement of mill holes in preparing stopes for mechanical loading to bring ore bodies quickly into production

and attendant dangers were eliminated, and the ore bodies were brought into production weeks ahead of the time which conventional methods would have required (see Fig. 2).

Careful time studies and consideration of all the cost factors on the part of one operator have been found to show that the cost per ton with the mechanical loader is \$0.2230 as compared to a cost of \$0.3971 per ton by hand-loading methods, and these figures may be accepted, in the light of long experience, as a good average.

sills in the stopes. After enough ore is mined out to provide headroom in the stopes which are about 50 ft. to 60 ft. square, a system of parallel tracks is laid, spaced to conform to the cleanup range of the loader, after which the back to a height of 30 ft. is shot down on the tracks, and the

Rock Drill Equipment as Applied to Mining

TRENDS to mechanization in the rock drill industry, already clearly established, have been increasingly apparent during the last year. While manufacturers of this type of equipment still have as their goal maximum power and minimum weight for their various models, there is also evident a pronounced trend toward durability, maintenance and ease of operation, which is certain to be appreciated by the mining interests where these latter attributes are becoming increasingly important.

By W. M. ROSS
Ingersoll-Rand Co.

Maintenance, meaning the cost of the spare parts required to keep rock drills in service, has always been an important consideration. At the same time, it must be realized that this charge generally represents considerably less than 1 percent of the total operating mining cost. Since this percentage is so small, obviously it is not

the expense of repair parts but it is, instead, the expense of delays resulting from breakdowns which raises operating costs.

Realizing this, manufacturers of rock-drilling equipment are taking all possible precautions to safeguard the user by striving to build even greater durability into every rock drill and

part. Even such small parts as Pawl springs have been the subjects of intensive study and research to prolong their service life or, in some instances, to displace them altogether with some more durable construction such as an air-thrown mechanism, etc.

In keeping with this trend has been the greater use of compressed air cushions in drill design, as a means of absorbing surplus power when not required for the particular work in question. This is particularly true, even in such tools as concrete breakers, which never before have been completely protected in this regard.

Reverse Feed Stoppers Introduced

Another interesting development in the past year has been the introduction of reverse feed stoppers and pneumatic columns as a possible replacement for drifters and standard columns for drift stoping. This seems to offer considerable economy in operation, particularly in medium and wide stopes where the ground is not excessively hard. Some demonstrations in important western mining camps have shown that the tonnage per drill shift has been increased 30 to 50 percent and even more, due to the facility of setting up and handling these lighter drilling rigs.

Where mounted drifters must be used, as in hard rock, narrow working places, etc., there is a very definite

trend towards the use of the auto-feed drifter as contrasted to the familiar hand crank rock drill. The auto-feed drifters are operated with vibration, motor or air feed. The first two methods seem to be generally preferred, because of their greater flexibility, safety and compactness.

Portable Rigs Find Increased Use

Wagon drills, long familiar to the road contractor and the quarry trade, are now finding some application in the mining field, both in surface and subsurface excavation. The mobility and speed of these units make it easily possible to place dynamite economically in the most effective locations, thus minimizing on secondary blasting costs.

It would appear that these portable rigs are destined to fill quite a field in surface pits as well as large underhand stopes in subsurface work. Where the rock conditions permit, these rigs readily handle drill steel changes of from 6 to 12 ft., which means that footages of 300 ft. of drill hole per drill shift are quite common, and under ideal conditions considerably higher records have been attained.

Core Boring Shafts

The large core-boring drill is another development which is increasing its usefulness in the mining industry.

These machines, drilling holes from 36 to 60 in. in diameter, are already in use in a number of mines, and there would appear to be no reason why somewhat larger diameter holes could not be drilled where it is desirable. These holes, from several hundred to 1,000 ft. or more in depth, have already proven ideal for ventilation, as well as for pilot holes for large shaft excavation.

Use of Detachable Bits Increasing

Detachable bits, already well known, are continuing to find increasing usefulness in large applications. This established trend is the result of mining studies made of the effect of detachable bits on complete mining costs, rather than simply comparing detachable bits against established blacksmith shop costs. This broader consideration of detachable bits would seem the proper point of view, as, after all, the important consideration to the industry can only be judged on the basis of their broad application.

Another contributing factor to this growth of detachable bits has been the recent appearance on the market of large-capacity grinders, hot millers and adequate oil and electric furnaces, with proper control. Now the operator can economically recondition large quantities of these bits and yet maintain a quality consistent with the factory-manufactured product.

Hints on Safe and Efficient BLASTING

By || Atlas Powder Co.
|| Cardox Corporation

Ways and Means to Greater Safety in Coal Blasting

By J. L. ROMIG
Technical Representative
Atlas Powder Co.

ANY successful safety program is based on: (1) better methods, (2) the best equipment, and (3) supervision and care.

Those who visit mines in many parts of the country cannot help being impressed how great are the rewards where thought is spent on these three

points. Greater safety produces increased good will and greater profits. In a word, greater safety is good business.

The difference is small between a successful safety record and a poor one. Methods may have been outmoded by changing conditions. Newer

and safer equipment may be available to reduce a hazard. Supervision, carefully set up, may have broken down.

So important is safety that a few suggestions do not seem out of place.

Suggested Methods Leading to Greater Safety

1. *The method of priming is important to safety.**

* The Ignition of Fire Damp by Coal-Mining Explosives: Safety in Mines Research Board, Paper No. 69.



Figure 1

Direct Priming: With this method the cap is placed in the last cartridge and points into the charge (see Fig. 1). When the charge is set off, the explosive wave, traveling toward the back of the cut, acts as sort of gaseous stemming. This contrary motion reduces the gun barrel action of the bore hole. For this reason, direct priming is the safer way to prime, especially in the presence of fire damp and dust.

Indirect Priming: On the other hand, when the cap is placed in the first cartridge at the back of the bore hole the explosive wave traveling outward makes the bore hole act like a gun barrel, shooting the hot gases of the explosive directly out into the room.

2. *Pointing the detonator into the charge reduces "misfires."*

When fired, the end of the detonator will easily pierce a 1-in. pine board at 15 ft. By pointing the detonator into the charge, this action of the cap end can be used to reduce "misfires."

This action of the cap end is especially important where bore holes are not thoroughly cleaned or where the cartridges have been separated by pulling on the leg-wires while tamping the charge. The directional force of the cap end helps carry detonation across separation.

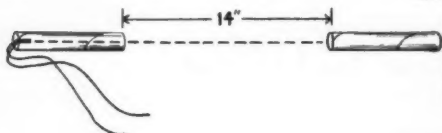


Figure 2

For example, the same explosives which failed to carry the explosive wave across a 7-in. air gap when the cap was pointed *away* from the other cartridge, shot across a 14-in. air gap when the cap was pointed *at* the other cartridge (see Fig. 2).

3. *Make tight, clean wire connections.*

4. *Use good blasting machines.*

Battered, wet or split blasting machines cannot deliver the "juice"—cause "misfires."

5. *Operate blasting machines properly.*

A lazy pushdown or twist may cause "misfires." Tests with the cathode ray oscillograph show that a

strong pushdown delivers 100 percent more current than an easy pushdown.

6. *Use good lead wires.*

Worn lead wires leak current—cause "misfires."

7. *Test your lead wires.*

(a) Test for current leakage. If the galvanometer registers there is leakage in the lead wires. (Fig. 3).

(b) Another test for current leakage. If the cap fires, there is current leakage. WARNING: Bury the cap in the ground (Fig. 4).

(c) Test for broken wires. If the galvanometer does not register, the wires are broken (Fig. 5).

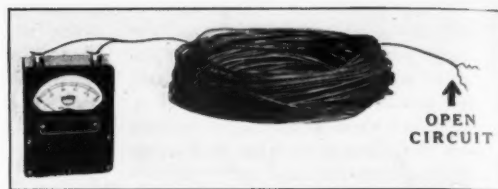


Figure 3

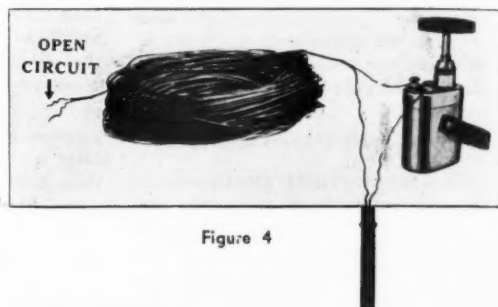


Figure 4



Figure 5

The Best Equipment Leads to Greater Safety

The best equipment, kept in good repair, is economy—that's an axiom in any well run business. It is doubly true where safety is involved.

Suppliers to the coal industry constantly are improving their products. Machinery is being redesigned, new materials are being introduced that are more efficient and safer to use. No operator can afford to overlook the economies these new developments offer. No operator can, in this competitive age, afford to overlook the advantages they offer in safety. Particularly is this true where safer materials can be used without large capital investment, or where no write-off of present equipment is necessary.

It is equally important, for economy and safety, that equipment be kept in good repair. As a minor example, "worn lead wires leak current—cause 'misfires.'" Who would "save" on the cost of good lead wire when the time lost by a misfire is computed?

Supervision and Care

Supervision is just as important to the success of a safety program as methods and equipment. Better methods, when adopted, must be carried out. The best equipment, when installed, must be properly used and used with due safety precautions.

Many mines have made one man responsible for preparation at the face—for cutting, drilling, loading, charging and tamping. Relieved of tonnage, transportation and mechanical loading worries, it is possible for him to follow up the safety program in actual execution.

Better methods, the best equipment—plus constant supervision and care—mean greater safety.

West Virginia Coal Conference

The annual Coal Conference on Combustion will be held September 28 to 30 at the School of Mines, West Virginia University, Morgantown. Another fine program is being prepared on various pertinent subjects concerning coal research and its correct usage, details of which will be announced a little later.

MINIMIZING OVERSHOOTING

By CURRAN CAVANAGH
Cardox Corporation

THERE has been a notable increase in Cardox blasting in the bituminous mines of Pennsylvania and West Virginia during the past five years. With mechanization showing a yearly upward trend, the demand for increased coarseness, increased sales realization, greater loadability for the mechanical loader, and increased safety because of higher compensation rates have forced the average operator to search for a method of blasting that will meet these requirements.

In the application of Cardox to proper coal preparation we are perhaps fortunate in one sense, in that we do little if any overshooting. By experiment or previous experience in the same seam we first determine the most suitable cartridge for the job at hand. Subsequently, it is a matter of hole placement and the most economical use of cartridges to give the best results to the mine management, whether for hand or mechanical loading. Generally we find that most operators are carefully watching their blasting costs.

It has been our experience in test work, that an increased shooting cost can easily be offset by square, clean ribs and faces, rapid loadability with no digging and picking in the case of mechanical loading, and good ventilation and air at the working face due to the absence of fumes after blasting, which especially affects efficiency and slows down the operation. In mines where loadability of coal and coarseness are not important factors, more efficient cleaning is possible because the bands are not broken up and can be more readily separated.

Also, it is possible to prepare the whole face before the entrance of the loading machine unit, where roof and slate conditions permit. If snub shots must be fired and loaded out before the top bench is shot, to give either loadability or coarse coal, then the delays experienced are rightly chargeable to that method of shooting, and if accurately measured will lower tonnages and raise costs.

Hole Patterns Cited

In shooting the 60-in. to 64-in. Pittsburgh seam of coal in Washing-

ton and Allegheny counties, Pa., the usual hole patterns for wide and narrow work are shown in Figures 1 and 2. Mines using our blasting equipment in that area are equipped with either mobile loaders or conveyors, and extended experience at these operations indicates that for a slight extra cost in face preparation, a reduction in $\frac{3}{4}$ -in. slack, and an increase in plus 4-in. lump of about 10 percent can be effected.

The Double Freeport seam in Allegheny county, Pa., is also being successfully shot with Cardox. In those mines cutting out the center boney

Figure 1

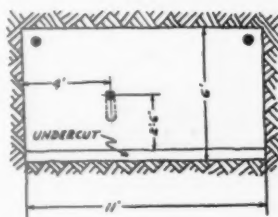
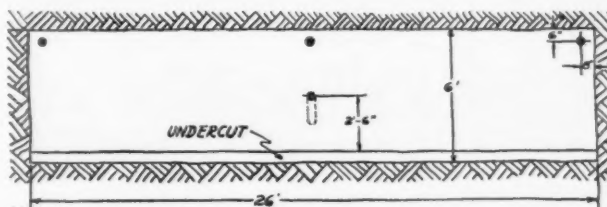


Figure 2

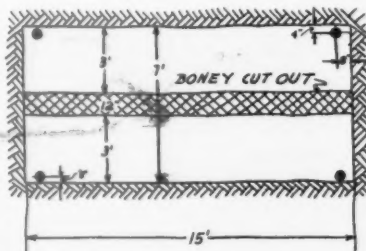


Figure 3

band, as shown in Figure 3, the problem resolves itself into shooting two separate benches of coal. Where shearing was formerly thought necessary in this seam, the application of Cardox in the two unbalanced cuts

has eliminated the labor and time involved in gobbing the sheared cuttings, where the double horizontal cutting is employed. This has meant the addition of one ton of prepared sizes per sheared cut, which was formerly lost. For a reasonable extra shooting cost, the plus 4-in. size can be increased from 10 percent to 14 percent over the previous methods with shearing.

Electric post drills are coming into wider use in the Pennsylvania area noted. Coal, as well as slate, is drilled from the same set-up, and in most cases, the same drill crew does the shooting.

In the thicker Pittsburgh seam of northern West Virginia, it is the practice to leave up head coal for roof protection. Universal track mounted cutting machines are coming into greater favor, and top cutting is preferred if coal analyses tolerances permit. Top cutting makes a smooth

regular roof, saves timbering, and protects the roof. Shearing is also popular in that area, and the shear may be located on center, off center, or on the clearance rib. Diagrams for hole

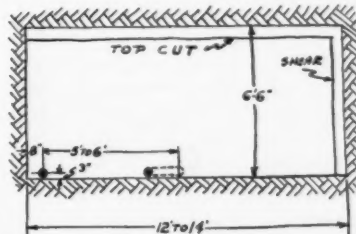


Figure 4

placement for top cut sheared places, and top cut places are shown in Figures 4 and 5. Coal that is top cut only is considered to be the hardest to shoot in the northern West Virginia area, especially where 8 ft. and 9 ft. cutter bars are used.

The question of whether to shear or not to shear is more a matter of the production cycle when using Cardox, because coarse coal can be obtained equally well either way. Sheared Car-

dox coal will cost less to shoot than non-sheared, but there may be no economy in this saving in the final analysis. Similarly the question of drilling off the cutting machine to reduce the crew size depends a great deal on the individual mine set-up.

Practices With Bottom Cutting

Where bottom cutting is practiced with track mounted machines or shortwalls, we have found split shooting—Cardox in the lower bench and explosives for the top bench—gives quite remarkable results. The former being slow in action and using low pressures of release but large carbon dioxide gas volumes to break down the coal, tends to work up and over a tender overlying strata unless some natural binder or cleavage plane intervenes and acts as a baffle.

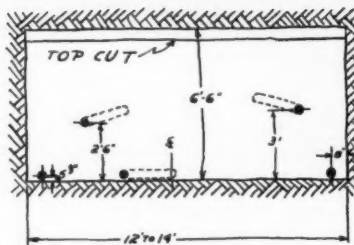


Figure 5

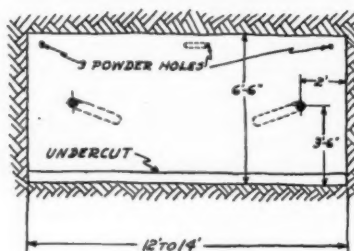


Figure 6

The hole pattern for this split shooting is shown in Figure 6. From 60 percent to 70 percent of the cut is thus dislodged with Cardox, and smaller charges can be used in the top holes thereby leaving a much stronger roof. Exceptional loadability can be gained and the whole cut prepared before the entrance of the loading machine. At a slight extra cost, this type of split shooting will yield from 8 percent to 15 percent more plus 2-in. coal over bottom cut coal prepared by other methods.

Hand held electric drills have been the most popular throughout this area, but within the past year, as in Pennsylvania, many post and track mounted drills have been successfully introduced. Better hole placement and more efficient shooting has been the result of this change, as well as greater safety.

Factors in Improved MINE HAULAGE

By Metal and Thermit Corporation
Electric Storage Battery Co.
Thomas A. Edison, Inc.
The Brown-Fayro Co.
The American Mine Door Co.

THERMIT WELDED RAIL for Main Haulage Track

By MERRITT L. SMITH
Metal & Thermit Corporation

COMPARATIVELY recent among developments in coal mine mechanization is thermit welding of rail on main haulage track. Between the first installation in 1937 and the end of 1938, however, more than 3,000 welds were installed in over a dozen different mines. While the majority of these installations consisted of only a small number of welds put in for experimental purposes, two important operators, the Hanna Coal Company and the Rochester & Pittsburgh Coal Company, installed long lengths of continuous rail, each involving from 150 to 750 welded joints on several of their mines.

The principal advantage of con-

tinuously welded rail, which might at first appear to be reduction in track maintenance expense through complete elimination of rail joints, is really the important saving made possible in power consumption. The thermit weld, compared with the rail itself, has full 100 percent electrical conductivity. In fact, it has been determined that approximately 20 percent more conductivity is obtained in track with thermit welded joints than in new track constructed in



Thermit welding rail in the Lucerne mine of the Rochester and Pittsburgh Coal Co.



Close-up view
of completed
thermit rail
weld

the usual way. The fact that this excellent conductivity is permanent and does not decrease with length of service when joints are thermit welded, cuts power losses to a minimum.

Although no figures are available as yet as to the actual savings effected, some indication is given in reports of operators of mine locomotives on one property, who say that the hauling power of their locomotives is markedly greater when operating over the thermit welded portions of that property's track.

Other and more obvious advantages of continuously welded rail are:

1. Complete elimination of rail joint and rail bond maintenance.
2. Smoother, and therefore, more high-speed operation with reduced spillage and fewer derailments.
3. Less wear and tear on locomotives and cars.

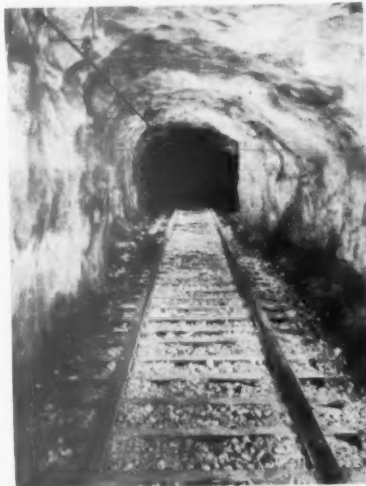
Actual welding with thermit is a relatively simple process and does not require operators with a high degree of skill or with any great technical knowledge. Labor ordinarily employed in other capacities may be trained readily for thermit welding and used to install welded track as occasion arises or when slack periods occur in other operations. The equipment required for work on such a basis involves an investment of less than \$1,000.

Welding costs vary with the number of welds installed. Cost per weld of a small trial installation is naturally higher than the cost per weld where

several hundred joints are to be made. Actually, if a mile or so of welded track can be put in, the cost exceeds by but very little that of track constructed with bolted joints and welded bonds.

Thermit Process Outlined

The thermit welding process is based on the high chemical affinity of aluminum for oxygen. Thermit is simply a trade name for a mixture of finely divided aluminum and iron oxide. Up



Continuously thermit welded rail in main haulage line of No. 11 mine, Hanna Coal Co., Don Glen, Ohio

to a temperature of 2800° F., this mixture is inert. At 2800° F., however, a chemical reaction takes place, the aluminum uniting with the oxygen

of the iron oxide and the iron being set free in the form of highly superheated steel at a temperature of approximately 5000° F. When liquid steel of this temperature is poured around two sections which are to be united, it is obvious that it will melt these sections and amalgamate with them so that the whole will cool to form a single, homogeneous mass or fusion weld.

Briefly, the procedure in welding rails with thermit is as follows: rail ends are first cleaned and rails are lined up carefully. One-quarter inch of the base and web of each rail is cut away with an oxy-acetylene torch. A set of rail clamps is attached and tightened so that the rail ends are butted together under pressure. The next step is ramming the molds and clamping them to the rails. The rails are then pre-heated until the portions inside the molds attain a red heat. The crucible, containing the proper quantity of thermit, which is packed in various sized bags, each size containing a correct amount for a prescribed rail section, is next set in place and the thermit ignited. The reaction which follows takes only about 30 seconds and produces a mass of superheated steel and a quantity of slag. The molten steel falls to the bottom of the crucible while the light slag floats on top. As soon as the reaction is completed, the crucible is tapped and the steel is permitted to flow into the mold. After allowing several minutes for the weld to cool, mold boxes and clamps are removed and any excess metal is cut away from the running surface and gauge side of the rail with a hot track chisel. In order to reduce the amount of grinding required to finish the weld, the top surface may be hammered while still hot. This hammering must be done carefully, however, in order not to injure the rail surface.

After the weld is completed, the running surface may be ground or filed to any desired degree of smoothness.

Improvements in STORAGE BATTERIES for Mine Locomotives

THE average person is fully cognizant of the fact that there has been great progress in the development and manufacture of automobiles, tires, radios, etc., and that they obtain today a very much greater value in such equipment for their dollar than they

ever did before. But few people not directly connected with the storage battery industry realize that great progress has also been made in the development of storage batteries, nor are they acquainted with the fact that such development has meant a really

By **WILLIAM VAN C. BRANDT**
Manager, Motive Power Battery Sales
Electric Storage Battery Co.

substantial reduction in the dollars and cents cost of owning and operating such mine locomotive batteries.

Increase in Life and Decrease in Cost

For instance, consider the mine locomotive type of battery. Actual service records kept on batteries as they have worn out show that during the period 1924 to date, the average life of the Ironclad type locomotive battery, which is in such wide use in mine service today, has actually been increased 83 percent. The average life in 1924 was 37 months, while the actual life of such batteries renewed during 1938 was 67.8 months. While this increase has been due to several causes, improvements in design and construction have been largely responsible.

During the same time, the pro rata guarantee and adjustment policy on the battery has been increased from 30 months to 54 months, or 80 percent. Furthermore, the actual service records show that during this period the actual average life delivered by the battery exceeded in every instance the minimum pro rata guarantee and adjustment period.

This increase in actual life and the increase in minimum guarantee and adjustment period would of themselves have had a vital effect upon the battery haulage cost, even if the price of batteries had been maintained at the same level as 1924 or slightly increased, but the actual fact is that prices have been reduced 14 percent over this period, so that the mine locomotive user is not only today getting 80 percent more battery than was obtainable in 1924, but he is getting this better battery at a 14 percent lower price.

With an increase of 80 percent in the pro rata minimum life guarantee and 14 percent reduction in price, the net result is that the locomotive battery user is actually getting a reduction of 52 percent in the guaranteed cost per month. In other words, the locomotive battery user today is getting for 48 cents that which cost \$1.00 in 1924. This fact is graphically shown in the accompanying graph.

A glance at this will show that the price of the battery in 1938 was 86 percent of what it was in 1924. This price line shows that there was an advance in price in 1925, a reduction in 1928, another reduction in 1931, a further reduction in 1933, and an advance of 7½ percent in 1937.

Meanwhile the guarantee was 30 months in 1924 to the middle of 1925, was increased 20 percent in 1925, further increased 11 percent in 1926, 29 percent increase made in 1933, and a 20 percent additional increase during

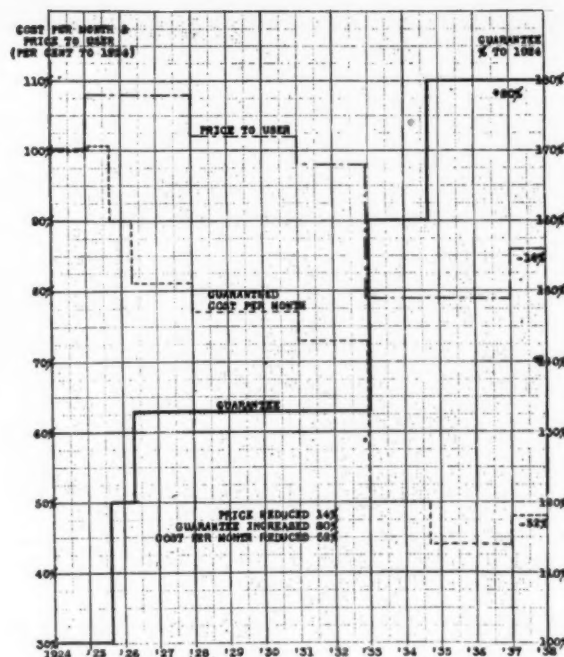


Chart showing changes in price, guarantee and cost per month of new Exide Ironclad batteries in locomotive service

the latter part of 1934—total increase of 80 percent over the period.

The guaranteed cost per month as a result of the decrease in price and increase in guarantee has been drastically reduced step by step to a total of 52 percent under what it was in 1924.

The above facts show, in the writer's opinion, a very interesting picture of manufacturing progress. The above monthly depreciation in cost is, of course, a maximum, and is greater than the actual depreciation cost, as the above figure is based entirely on the minimum guaranteed life of 54 months. Actual records show that the average life of such batteries is considerably greater than the pro rata minimum life, and such increased life obtained in excess of the guaranteed minimum life serves to reduce the monthly depreciation figure very materially.

Capacity and Size Increased

A further development has been made in the matter of capacity and size. From the normal sized battery having a capacity of 34 ampere hours per positive plate at the normal discharge rate, another slightly higher type has been brought out, having a capacity of 50 ampere hours per positive plate. The width of the plate was maintained and the increased

capacity secured by raising the height from 15⅜ in. to 20⅜ in. Where the headroom is available, this means an increase of 50 percent in ampere hour capacity of the battery in the same square area of battery compartment.

Later, another type of locomotive battery was developed, having a capacity of 55.8 ampere hours per positive plate. The height of this battery is 17⅞ in. and the width dimension slightly increased. This battery was also assembled in rubber compound containers instead of the usual wood trays.

In order to obtain even greater capacity, one was developed which has a capacity of 100 ampere hours per positive plate, and this battery is available up to 1,000 ampere hours of capacity in a 21-plate cell wherever there is sufficient headroom to accommodate the height of 28⅜ in.

With the development in size, there is available today to the locomotive user as much capacity as is required to meet practically any and all locomotive haulage conditions, and these batteries are all available at a lower cost than was possible in years past.

The storage battery industry has thus made very substantial progress which is to the benefit of the locomotive battery user.

Using Storage Battery Equipment to Control Power Costs

By **GEORGE E. STRINGFELLOW**
Vice President
Thos. A. Edison, Inc.

USE of storage battery locomotives for coal gathering or metal tramming service often serves as a means of reducing the maximum demand and thus, of effecting a saving in the cost of electric power, since the usual schedules of mine operation are such as to permit charging the batteries during intervals when other loads are not connected.

In a metal mine in which battery tramming is employed, hoisting is done between 10 a. m. and 4.30 p. m. and between 7.30 p. m. and 2 a. m., which leaves a period of approximately two and one-half hours between the day and night shifts and another period of approximately five hours from 2 a. m. to 7 a. m. for battery charging. In this way, there is no load on the line for battery charging at the same time that the hoisting load is connected; and the result, in some mines, is virtually free power for charging the batteries.

Flattening the Load in a Coal Mine

In a coal mine in which cars are loaded during the day shift, the use of storage battery locomotives for gathering, and division of the coal-cutting load between day and night shifts both play a part in flattening the total load. During the day, the principal loads consist of a.c. tippie motors operating shaker screens and conveyor, two a.c. coal-cutting machines, and one 100-k.w. motor-generator supplying 250 volt d.c. power to two eight-ton haulage locomotives. At night, the principal connected loads consist of three a.c. coal cutters and the 100-k.w. motor-generator which now supplies power at slightly less than 200 volts for charging six gathering-motor batteries. By thus spreading and flattening the load, it has been possible, in this mine, to employ a 200-k.w. load limiter.

It is estimated that if the power for the operation of the gathering motors were obtained during the day at the same time the haulage motors are in operation, a motor-generator of a capacity at least 250 k.w. would be required. As it is difficult to predict how many times all the motors might start and accelerate simultaneously, it

Charging a
trammer
motor
battery
between
shifts



is possible that a motor-generator of still greater capacity might be necessary.

The staggered operation of the coal cutters, two during the day and three at night, also assists in flattening the total load.

In the same mine, the motor-generator employed is synchronous, which gives close to a 100 percent power factor on more than half the total energy consumed during a 24-hour day, and also serves in place of a capacitor to balance out the current lag on other loads.

Thus, a further saving is effected under power tariffs which provide for low energy charges as long as the demand is kept flat and the power factor is held to 100 percent.

Although the principal power savings effected by the use of storage batteries are usually obtained when it is possible to schedule the charge during off-peak periods, some saving is also possible when the exchange-battery system is employed and charging is continuous. This arises from the fact that charging loads are usually much steadier than motor loads.

Under the modified-constant-voltage-method of charging, now in more common use than any other, the starting rate is usually approximately 140 percent of normal, and the finish rate approximately 78 percent of normal. On the other hand, a locomotive-motor load may rise to as much as six times the normal running load during starting.

HAULAGE AUXILIARIES for Conveyor Systems

By **H. V. BROWN**
President
The Brown-Fayro Co.

PORTABLE hoists of special design are an important part of any mechanical system of loading coal in which conveyors are used to move the coal from the working faces to the mine cars on the room or haulage entry. In the early applications of conveyors, the practice was to handle the mine cars being loaded either by gravity or electric locomotives, but neither means was satisfactory, prin-

cipally because of the lack of adequate control over the movement of the cars. Attempts have been made to employ the small portable hoists which had formerly been used in the mines for the movement of cars in units or small trips, but it was usually found that such hoists were inadequate for the service. As a result, about ten years ago, portable hoists were designed for this particular duty,

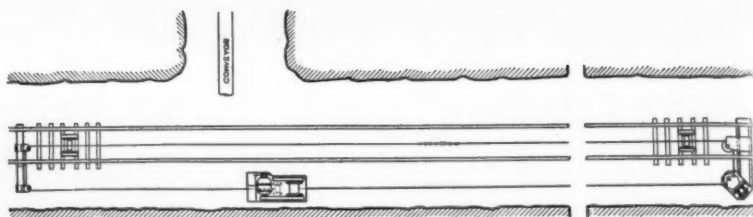
taking into account the necessity of a heavy rope pull at relatively slow speed.

The first of these car spotting hoists was designed for a rope pull of 5,000 lb. at a speed of about 30 ft. per minute. As a result of the experience gained with these early machines, this unit has been developed to the point where it now embodies such features as total enclosure of the working parts, anti-friction bearings throughout, spring actuated spiral jaw clutch mechanism, low over-all height, and a steel frame with base having turned up ends to facilitate moving from place to place. This type of hoist is essentially a "hauling and holding" unit, and is now usually rated for 6,000 lb. rope pull at 25 ft. per minute.

Heavier Types Developed

With the growth of conveyor loading systems came the demand for even more powerful car spotting hoists capable of handling heavier trips of cars, such as might be hauled by locomotives of 15 to 25 tons capacity. To meet this condition a unit embodying the same principles was designed, suitable for rope pulls of 10,000 to 12,000 lb. at 30 to 35 ft. per minute and equipped with 7½ to 10 hp. motors of special construction for hoist service. The accompanying illustration shows one of these machines at work in what is termed a remote control set-up. In this instance the hoist is located about 500 ft. from the conveyor loading point and, as will be noted, the rope leads directly to the trip of cars being handled.

Two systems have been developed for the use of these car spotting hoists, the choice depending on local conditions. The first, or remote control set-up, is that shown by the illustration where the movement of the



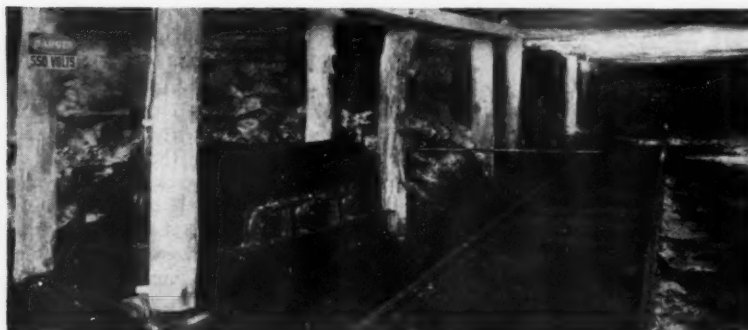
Plan for operating car spotting hoist with high speed tail rope

trip of cars being loaded is controlled by a man located at the loading point. The other system locates the hoist at the loading point, with the rope carried around a head sheave placed approximately a maximum trip length away. Generally speaking, the first system is most applicable where empty cars are brought in and loads taken away from the front or outby end; the second system is advantageous where empties are brought in at the rear and loads taken out at the front. Experience indicates that it is always desirable to haul the trip against the grade, even though this may mean reversing the location of the car spotting hoist and the method of handling the cars.

Further development of these hoists came with the introduction of the mother belt system of conveyor loading where a number of room conveyors discharge on a belt, which in turn empties the coal into the cars on the butt or haulage heading. For such service it is necessary to provide not only a powerful rope pull, but also greater speed, and to minimize the delay in changing ropes as the trips of cars are loaded out. To meet these conditions the car spotting hoist should be capable of a rope pull of approximately 12,000 lb. at 50 ft. per minute and be provided with a high speed tail rope, the function of which is to bring the main rope back promptly after it has been discon-

nected from the loaded trip. The working system which has been found most suitable is shown in the accompanying sketch. With this outfit it is possible to maintain a practically continuous rate of loading, the intervals necessary for changing trips being not more than three to five minutes. It is very essential that the locomotive haulage be so arranged as to bring the empty cars in at the rear and take away the loaded trips from the front or outby end.

Another type of hoist has recently been employed in connection with conveyor loading systems. This is a modified form of room hoist which can properly be termed an auxiliary, or rigging hoist. It is provided with a special base and jacks, and is used for handling supplies, such as conveyor pans, chains, timbers, etc., from the loading point to the working faces. Its greatest use, however, is in connection with moving from one set-up to another, which can be accomplished in a fraction of the time required by any other method yet developed. Due to its construction this hoist can easily move itself to a new location, and then be quickly set in place by means of the jacks. It can be used to haul the various units of the conveyor, also the mining machine, to the new set-up. This hoist is geared for a normal rope pull of 2,500 lb. at a speed of about 70 ft. per minute. This slow speed has been found desirable in that it permits a man to crawl along behind the load being hauled, guiding it from interference with projecting ribs, posts, etc.



Model HKD car spotting hoist at work under remote control

R. W. EICHENBERGER, vice president of the Robins Conveying Belt Company, formerly acting as manager of their Chicago office, has been transferred to the New York office at 15 Park Row, where he will collaborate in general sales management for the company with Mr. H. VON THADEN, vice president.

MODERN MINE SIGNALS

By GLENN D. GURNEY

Design Engineer
The American Mine Door Company

MANY mining men are recognizing a need for automatic signals on their mine haulage. Invariably the motives prove to be—"lower costs and increased safety." While these are definitely independent reasons it is generally accepted today that safety pays in decreased costs. So, aside from the humanitarian aspect of a low accident rate and pride in a good safety record, the practical desire to lower operating costs may be the sole factor.

Granting for the moment that a signal system is desirable if it will pay for itself, let us direct our attention to its cost. This may be broken down into the following items:

- (a) Investment in signal equipment.
- (b) Investment in wire and hangers.
- (c) Installation labor.
- (d) Power.
- (e) Maintenance.

The first item will be furnished by any reliable signal manufacturer, and the second and third are easily estimated by any electrical man. Suffice it to say that quite a comprehensive automatic signal system will run \$3,000 to \$4,000 for these items. On a ten-year 4 percent basis the amortization of \$4,000 will cost \$322 per year.

A modern relay takes operating current only for the instant of operation. This is negligible even over a year's time. The only other power consumed is that for the lights, one of which is always burning at each relay. This may be estimated in the neighborhood of \$75.

The cost of maintenance varies with the extent of the system and number of rock falls. This may be lumped at the cost of equipment over a ten-year period or roughly \$200 per year. While in specific cases any of these items will vary from that given, we have a fairly average figure of \$600 per year.

Estimate Ultimate Savings

In estimating the savings due to the installation of automatic signals,

no amount is given for many of the items. This is done to avoid quibbling on small or seemingly obscure items or where an average figure may be so at variance with actual figures as to be meaningless. Where interested parties consider these items of consequence they may put in their own figures. However, some or all of the following items contribute to the cost of operating a haulage system without automatic signals:

- (a) Wages of trapper or dispatcher.
- (b) Halted trip time (calling for road).
- (c) Power consumed starting halted trip.
- (d) Maintenance due to excessive wear account of starting and stopping trips.
- (e) Cost of delays at faces or tippie account of haulage.
- (f) Repairing rolling and way equipment account of accidents preventable by signals.
- (g) Cost of lost time or fatal accidents preventable by signals.
- (h) Higher cost of present haulage over cost of anticipated increased haulage capacity with automatic signals.

Where a trapper flags a cross over or junction, cost of his services, including labor, labor overhead and taxes, will probably exceed \$6.00 per day. This, on the basis of 100 days a year, will pay for our estimated signal installation alone. If a dispatchers' wages are saved, the difference is likely to be more pronounced. However, usually all of the dispatcher's time may be used to best advantage distributing cars on the sections.

The cost of starting and stopping halted trips, including power and wages, may be placed at 10 cents per stop. It is estimated there is the same amount of waiting time for other trips to clear with or without signals. But only one-fourth of the trips are halted on automatic signals, whereas all of the trips are halted where they must call for the road. On a total of 40 trips per day a savings here is represented of \$300 per year on a 100-day basis.

In discussing items (d) (f) (g) with reliable mining men, it is estimated maintenance charges on motors and cars is reduced about 2 to 4 percent. They also estimate on mines producing from 5,000 to 10,000 tons daily, there may be expected one fatality or its equivalent in lost time accidents in a 10-year period that would have been preventable with automatic signals.

The cost of delays in the delivery of loads or empties preventable by automatic signals may run from nothing to a serious figure. Idle loading crew time, for instance can assume a substantial amount over a period of years and contribute in some cases the total cost of a signal installation.

Quite often a mine's producing capacity is governed by the haulage system. In many of these cases a properly designed signal system will increase the capacity of the entire mine. Where this is possible and desirable, the investment in automatic signals will pay profitable dividends. From a compilation of figures covering the various items mentioned above it should be an easy matter to determine whether there is a possible savings due to the installation of a signal system on the haulway. Where such is the case a specific estimate should be obtained from a reliable signal manufacturer.

Operation of System

A modern signal system should give three indications:

- (a) Stop—Red Light—Block occupied.
- (b) Proceed—Green Light—Clear Road.
- (c) Approach—Purple Light—Block unoccupied.

A motor runner on approaching a block and seeing a purple light passes the setting contactor mounted on the trolley wire. The contactor sets the relays in operation—those at all other stations, or entrances to the block, moving to the red position, the relay at the setting station then being permitted to display a green light. It is possible to obtain only one green light at one time in one block. All setting contactors lock out while the block is occupied. The green "proceed" signal is maintained over an adjustable period of five to 45 seconds, after which it is extinguished and replaced by a red light, thus halting all other trips attempting to enter the occupied

block. The trip on leaving the block passes a cutting or restoring contactor which restores the relays to normal position, extinguishing all red lights and displaying purple lights.

The relays in a block are connected by two trunk wires. Relays may be mounted in safe positions from damage such as break-throughs. The lights,

being independent of the relay cases, may be mounted to suit the motor runner's visibility. Where desirable, lights indicating the conditions in one or more blocks may be mounted in the dispatcher's office. Many special conditions may be worked into the relays to handle unusual situations.

The past two or three years have

been noted for outstanding improvements in automatic mine signals. The American Mine Door Company, an old established firm in the mine signal business, have been leaders in this movement. Their engineering department is available to those interested in obtaining the latest and most efficient signal equipment.

Savings Through Efficient POWER APPLICATION and CONTROL

By || General Electric Co.
|| Ohio Brass Co.
|| I-T-E Circuit Breaker Co.

Some Considerations in Selecting ELECTRIC MOTORS for Mining

By F. L. STONE
Engineer, Mining and Steel Mill Section
Industrial Department
General Electric Company

THE selection of motors for the mining industry is not, generally speaking, very difficult. The size, speed, and type of motor—whether a.c. or d.c.—is usually determined by the manufacturer of the machine to be driven. The method of starting, whether it be reduced voltage or across-the-line, is something that is more or less optional with the operator, of course consistent with good practice.

D.c. motors of 5 hp. and larger should be started by the reduced voltage method. It should be borne in mind that d.c. motors of the series or heavily compounded type produce excessively high instantaneous torques when thrown across the line. This high torque frequently results in broken mechanical parts. Induction and synchronous motors may be thrown across the line if the transmission lines will permit the high inrush current which are always associated with across-the-line starting.

The most important requirement in

the application of a motor for mine use is that the manufacturer of the motor must have a thorough knowledge of the conditions under which this motor is to operate. Most mines are intensely humid, and if motors or any other good heat conductor are left idle, water vapor will condense on the surface and will even penetrate into the inner parts of the frame in totally enclosed motors. This penetration is caused by change in temperature of the air inside the motor. As the motor cools off, the inside air contracts and drops some of its moisture. Repetition of this breathing process will in time cause pools of water to collect inside the frame. The only means of really preventing this is to keep the motor above the atmospheric temperature during idle periods. This is easily accomplished by means of small, inexpensive heat units which should be installed inside the frame. In case no power is available to operate these units, a well made canvas cover is very effective.

Eliminate Projections on Motors

All underground motors should be as free as possible from any projections, as these invariably become broken or knocked off entirely. The motors used on standard cutting machines today in the coal industry are a fine illustration of this development. Totally enclosed fan cooled motors, where such are indicated, should have the fan protected by a very strong perforated metal shield, or its equivalent. Ordinary wire gauze or light expanded metal usually does not protect the fan more than a few days, as they are invariably bumped by something underground which might easily destroy the fan.

Motors in Coal Mines

Working from the face to the shaft in coal mines, we encounter first the coal cutting machines which are equipped with built-in motors, by the manufacturer. These motors are invariably low in height; the frame is made of cast steel, and of the box type construction. A serious fall of roof could do little or no damage to one of these machines.

We then encounter electric coal drills, used to prepare the face for shooting. It is a small portable device which should be, like the cutter

motors, totally enclosed and explosion proof, since gas when present is usually encountered first at the face. It should be as light as possible and still mechanically very strong.

The mechanical loaders, which follow the drilling and shooting, are usually equipped with motors selected by the loader manufacturer. There may be one or four motors on these machines, depending on the type. Frequently one motor drives the entire machine through clutches. In other cases, a motor is supplied for each of the various motions. The main motor which does the digging should be of the construction similar to those found on the cutting machines—extremely rugged, and capable of carrying heavy overloads for short periods—while the auxiliary motors may be more or less of a general purpose type.

Conveyor motors can very easily be made of the general purpose type, and may be either a.c. or d.c., as conditions indicate. In a great majority of cases the material is loaded directly from the loading machine into cars, which are picked up by gathering locomotives, made up into trains, and shipped to the foot of the shaft, or to the tipples in case of drift mines.

The hoisting equipment is in every case something more or less special, but here the control is, in all probability, the most important feature and should be given serious consideration by a competent engineer.

In the case of coal, tipples and washeries frequently indicate the use of totally enclosed fan cooled motors. These motors can be of the general purpose type. In cleaning plants that are extremely dusty, attention should be given the control of these motors, as it is quite possible to have a very serious explosion if large quantities of coal dust are in the atmosphere surrounding the opening circuit breakers. Fortunately, the majority of new tipples today are equipped with dust absorbers, and consequently this hazard does not exist.

Motors in Metal Mines

In the metal mines, more or less the same comments will apply. There are, of course, no undercutting machines, but they do have loaders and locomotives. In the metal preparation plants, such as smelters, etc., here again the general purpose motor finds a wide application.

The proper motorization of the grinding mills is probably the most difficult found in the metal preparation plants. Here, in the great ma-

jority of cases, synchronous motors are used, and the starting of these heavy masses offers quite a problem. A figure most generally used for breakaway in the metal industry is 175 percent torque. This occurs at the point of cascade, in the ball and tube mills. From then on the motor must supply sufficient torque to bring the mill up to running speed, and in the majority of cases a 110 percent pull-in torque at 95 percent speed is usually sufficient to complete the starting cycle.

Synchronous motors have been used most advantageously on both coal mine and metal mine fans. Here the starting load is very low, but the pull-in torque at 3 percent below synchronous speed must be very high. This sometimes necessitates the use of 80 percent power factor machines, or a machine slightly larger than the running load indicates.

The proper application of motors to mines is a first class example of where the application engineer can do a real job. He may be the operator's engineer or the manufacturer's engineer, or, as in many cases, both.

Conditions met in mines differ greatly from those encountered above ground. The engineer must be most intimately informed of these conditions, and as to how to meet them. Unfortunately, what will work well in one mine will be totally unsuited for other mines.

The treatment a motor receives

under ground is usually not quite the same as is found in the majority of cases above ground. The illumination is not good. The space is restricted and proper tools to work with are not always to be found.

Small defects develop which would usually be corrected quickly on the surface, but go unnoticed under ground until they become serious enough to put the motor out of service.

Moisture and even dripping water, which frequently is highly acid, has to be contended with in many mines.

Explosive gases given off by the coal are found in many coal mines. When or where this gas will be encountered in dangerous quantities cannot be predicted. In such cases explosive proof motors are indicated. Such motors are available but, unfortunately, not used as frequently as they should be.

In new development work the use of a.c. motors should be seriously considered.

Warns Against Undersize Motors Underground

Many operators have made the statement, more or less seriously, that they have never had any motor big enough under ground. While this sounds like an exaggeration, it should be borne in mind that under the adverse conditions under ground the last thing an operator should be bothered with is an under-sized motor.

Common Power Losses and Their Prevention

By F. F. SMITH

Development Engineer
Ohio Brass Company

IT IS said a chain is no stronger than its weakest link. In this respect a mining operation is no better than its haulage system. This may be qualified, however, by saying that local conditions, such as output, distance and equipment determine, to a great extent, what the requirements of the haulage system should be.

The electrical haulage system can be divided into two parts—trolley and feeder wires for the positive side of the circuit, and rails, bonds and negative feeder forming the negative side or return circuit. It is good practice to have the voltage drop equal between

the positive and negative sides of the circuit. This assures the best voltage conditions at all parts of the circuit.

There is no standard permissible voltage drop. The allowable drop depends entirely on local conditions. An isolated motor operating a pump may be allowed a greater voltage drop than would be desirable on a main haul or at a face where there are a number of machines which have to be run at normal speeds for economical operation.

In order to determine accurately if a conductor, feeder or trolley is the most economical, Kelvin's law

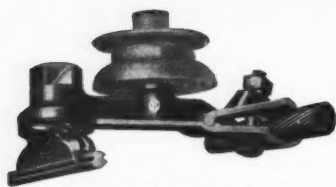


Fig. 1. Double suspension unit

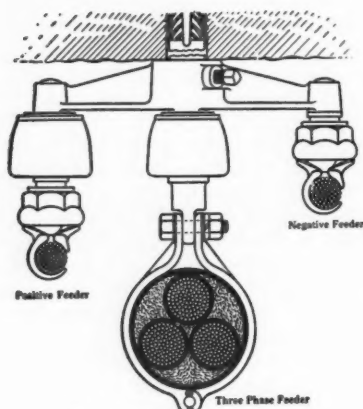


Fig. 2. Triple supporting yoke

can be applied. Stated simply it says, "The most economical size of a conductor is that which makes the annual cost of I^2R losses equal to the annual interest on capital cost of the conductor material plus the necessary annual allowance for depreciation." In other words, when the cost of I^2R losses or wasted power is greater than the annual cost of interest plus depreciation of the conductor investment, the size should be increased. The cross-section is therefore determined solely by the current-carrying capacity and not by any arbitrary limit of voltage drop.

Trolley Wires and Feeders

The trolley wire serves two purposes, one to conduct the current and the second to impart this current to the collector. It should, therefore, be large enough to carry sufficient current and also withstand the mechanical wear of the collector. In its capacity as a current carrier, it is augmented by a feeder system tapped in at definite intervals. As an impartor of current, lubrication or conditioning of the wire will decrease the wear and add many more collector passes to its life.

The trolley wire alone will rarely suffice to carry the required current. To this part of the positive circuit, then, a feeder is added. The feeder can either be carried along on the rib with separate insulators or it can be

suspended from the top with feeder wire insulators or standard hangers and feeder wire clamps. When this method is used, feeder clamps should be installed on the trolley wire at intervals of 150 to 400 ft., depending upon current requirements. Taps should be run from the feeder cable to these clamps.

Another type of construction couples the feeder and trolley together in one clamp, such as a double suspension unit where one part of the device clamps and supports the trolley wire and another portion clamps and supports the feeder wire, the whole being attached to one hanger secured in the top or on timber or I-beams (Fig. 1). The triple supporting yoke (Fig. 2) offers a means of supporting three circuits which may, or may not, be insulated from each other.

The cost of additional copper to carry the required current may be so great that it would be more economical to install a portable substation at some place in the mine to supply additional energy closer to the point where the requirements are heavy.

In planning feeder and trolley requirements for the future, the construction should be planned so that feeder wire can either be supplemented, or moved forward so that a larger size can be installed in its place, thereby adding to the current-carrying capacity and reducing the cost of wasted power.

Return Circuit

The rails in a return circuit should always be bonded to give an unbroken electrical conductor. These bonds can be of the mechanical type or of the type which are welded to the rails. In either case it should be emphasized that a bond is no better than the contact it makes with the rail. It is obvious, therefore, that bonds with low contact resistance are superior and lower in final cost than those whose contact resistance is relatively high.

The size of rail chosen is usually governed by the weight of equipment which will operate on it, consideration being given to spacing of ties and the nature of the bottom on which the track will rest. The current-carrying capacity of the rail is not of primary importance, but after the size of rail is determined for mechanical reasons, the bonding then becomes an important item.

It is not economical to bond rails with bonds of greater capacity than

the rail; for example, a 16-lb. rail should not be bonded with 4/0 bonds. However, it is economical on heavy current to bond up to the capacity of the rail, and when that is not sufficient, that is, the rail return itself does not have sufficient capacity, it is often economical to add a negative feeder. This is governed by the application of the previously mentioned rule regarding cost of power versus cost of interest on additional investment required.

As previously stated, bonds can be applied by arc welding or by mechanical means. Arc welded bonds are further divided into two classes—steel electrode and copper alloy electrode. The use of steel electrode requires a current of around 120 to 130 amps, while copper alloy electrodes require a much heavier current, around 190 to 210 amps. This larger current requirement is often not available in remote sections of a mine with the result that copper welds are not sound. Steel weld bonds are the only logical choice under these conditions.

Mechanical bonds are innumerable in design and application, but those applied by wedges, pins or bolted connections are perhaps the most logical considering the endurance of the mechanical contact. These bonds are used mainly for their reclaimability when tracks are to be moved; however, recently developed mechanical



Fig. 3. Dual overhead construction, where feeder and trolley wire are carried in combination clamps

bonds can be recommended for permanent installation.

Cross Bonding

Cross bonding is essential at regular intervals to maintain an unbroken return circuit in the event a joint bond accidentally becomes broken or torn off. The usual practice is to place these bonds at 150 to 300-ft. intervals. They should be of the same

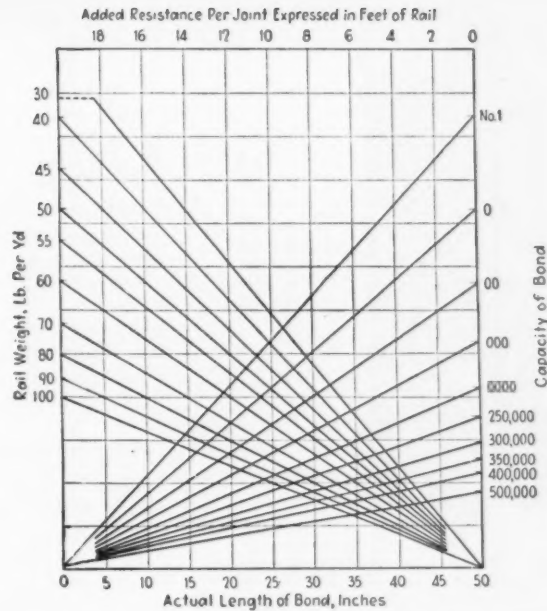
capacity as the joint bonds, inasmuch as the cross bond will be required to carry the current in one rail around a section where a joint bond failure occurs.

It is also good practice to install cross bonds at all turnout points. Three are required, one at the single end and one at each of the leaving ends of the turnout. A short bond is also used to join the ends of the rail at the heel of the crossover in the track. This procedure will bond a turnout completely and provide a continuous return circuit.

Regular inspection of bonds is very important. They often become covered over with coal falling from trips and, being out of sight, are easily overlooked. The cost of lost power in joint bonds which are not properly welded or are in bad condition because of some mechanical failure will, in time, be greater than the cost of a regular inspection and maintenance schedule. A convenient chart (Fig. 4) can be used to advantage to determine added resistance of bonded joints.

A haulage system is for one purpose only—namely to move the coal from the face to the tippie at the lowest possible cost. In this day of

Fig. 4.
Chart used
in determining
added resistance
of bonded
joints



keen competition, and with the many other factors affecting cost, it is essential that the haulage system be maintained at peak efficiency. This is

possible only by properly installing proven materials and maintaining them by frequent inspection and repair.

FUNDAMENTALS of AUTOMATIC RECLOSING CIRCUIT BREAKER APPLICATION

By DONALD J. BAKER
Assistant Sales Manager
I-T-E Circuit Breaker Company

AUTOMATIC reclosing circuit breakers for mining applications are manufactured in two general styles—(1) the open, or switchboard type, suitable for use within the substation; and (2) the enclosed, sectionalizing type for use anywhere within the mine on an intake airway trolley or feeder circuit. There has been little need for a permissibe sectionalizing unit since installations are rarely made close to the working face.

The proper selection of the correct automatic reclosing circuit breaker therefore depends at the outset upon whether the proposed installation is for a substation switchboard or for an isolated trolley location. If the application is for the substation, then

the ampere rating of the circuit breaker should be determined next. Generally, circuit breaker ratings for generator, converter or rectifier applications are selected slightly above the full load rating of the machine to be protected. The following table of ratings covers the capacity of the more commonly used substation equipment and can be considered good practice:

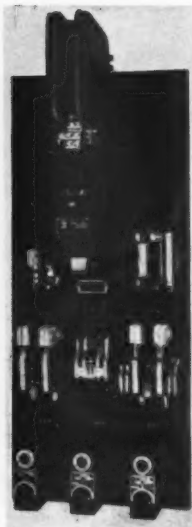
Generator, Converter or Rectifier	250/300 Volts Full Load Rating	Circuit Breaker Rating
100 K.W.	363 Amperes	600 Amperes
150 K.W.	545 Amperes	800 Amperes
200 K.W.	728 Amperes	1200 Amperes
300 K.W.	1090 Amperes	1600 Amperes
500 K.W.	1818 Amperes	2000 Amperes

For 500/600 volt service, circuit breaker ratings are available at half of the 250/300 volt ratings for the same capacity substation. The overload calibration for any nominal rating may offer an adjustment between approximately 50 percent of rating to 200 percent of rating.

Once the proper rating has been selected for the switchboard circuit breaker, the proper service classification is determined. Various control relays are available which permit a wide selection of service for any combination of protective and operating characteristics.

Any automatic reclosing circuit breaker actually consists of a basic circuit breaker element for closing, handling and interrupting a load circuit and the necessary control relays to govern the performance of the circuit breaker. While the circuit breaker element rarely varies with the kind of performance desired, the control relays change materially.

If the circuit breaker is to protect a substation in a system by itself and



Type KSA,
1200 amp.
feeder
generator
panel

the circuit is independently, or so-called stub-end, fed, then a simplified form can be used which includes a load measuring relay. Such an instrument is known as a feeder circuit breaker, and locks out on all short circuits and load values in amperes in excess of the setting of the relay.

However, if the circuit breaker is to protect a substation operating in parallel with others located in the same system at remote points, then the service classification may include protective features for many contingencies. Such an instrument is known as a combination feeder-generator circuit breaker, and incorporates two kinds of automatic reclosing control with automatic selection of the proper control as indicated by conditions on the system at the time of opening—an independent circuit would call for a load measuring relay to govern reclosing, whereas a multiple fed circuit would be best controlled by a voltage differential relay in reclosing.

Reverse current protection may be desirable and even necessary, as well as voltage directional protection, which prevents reclosing of a circuit until the voltage is definitely higher

on a previously selected side of the line.

If the switchboard circuit breakers are to be used in a multi-unit substation, then there will be both generator circuit breakers needed and one or more feeder or feeder-generator circuit breakers. The generator units would be equipped to provide certain operating characteristics and the feeder units another type of performance.

Another service classification is the tie-feeder circuit breaker which connects two feeders only when there is a minimum voltage difference between them, indicating reasonable conditions for paralleling the circuits.

Wide Selection of Control Relays

There is a very wide selection of control relays and practically any special problem peculiar to a specific mining condition can be engineered so as to provide any predetermined performance. This is particularly true of automatic reclosing circuit breakers for full-automatic substation duty.

Factors Applying to Sectionalizing Units

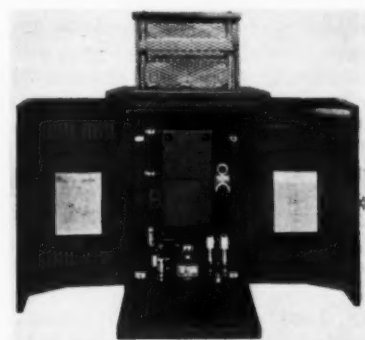
In selecting the proper automatic reclosing sectionalizing circuit breaker, other factors must be considered than those which govern the choice of the switchboard instrument. Generator protection ceases to be an issue; instead, the rating is determined by the size of mining machines, loaders and locomotives on the circuit.

In mechanized mining practice the loads of the mechanized sections become nearly equal and standardized. As a result, sectionalizing units of the same rating may be selected throughout the mine. In choosing a suitable rating for the circuit breaker the total horsepower of the machines on the circuit may be multiplied by 3 for a 250-volt system. A 75 percent diversity factor may be used, which is offset if voltage dips of 25 percent are encountered as is not uncommon.

Service classifications of automatic

reclosing sectionalizing circuit breakers are simpler than the switchboard units. These are usually feeder or tie-feeder instruments. In the case of the former, it is applied on both independent or multiple fed circuits, where it serves equally well. Tie feeder circuit breakers are governed in reclosing by voltage conditions on either side of them, whereas a load measuring relay controls the reclosing of the feeder units. The latter can be satisfactorily operated on circuits having a downward regulation of 50 percent voltage, and will lockout on faults where the voltage fluctuation may be very wide.

Others factors such as roof conditions, grades of haulageways, load



Type KSC automatic reclosing sectionalizing
circuit breaker

locations, size and distances of feeders are important, but these influence the application only from a location standpoint.

The application problems presented by machine loading are little different from those encountered in hand loading. Of course, in mechanized mining the machinery investment is much higher and there is a greater need for the circuit breakers to protect the steady operation of that investment. Automatic reclosing circuit breakers are part and parcel of mechanized mining, and are contributing an important service to the new economy.

Award to Mining Extension Students of West Virginia University

Recipients of flame safety lamps awarded by various donors for excellent records made by students of the mining extension department of West Virginia University during the year of night classes included the following: F. T. Carter, an employee of the Nellis Coal Corporation, who turned in the only perfect paper on the competitive examination; J. B. Whitehead, Earl Belcher, Sam Camp-

bell and Elmer L. Murphy in classes conducted at the Pocahontas Fuel Company mine; R. W. McCorkle, of the American Coal Company; L. G. Hurst, of the Turkey Gap Coal Company; Edward Ellison, of the Beckley district; and G. H. Skelton, of the Mt. Hope district.

Ely Mine Sinking to Lower Levels

The Nevada Consolidated Copper Corporation was recently preparing

to sink the Star Pointer shaft at Ruth some 200 feet below the No. 9 level in order to develop ore that has been proved by drilling operation. Life of the Ruth mine will be extended a number of years by this new development, according to General Manager J. C. Kinnear, who has also reported that surface and underground drilling are being carried on over a wide area in order to explore new territory. Some of these holes run up to 1,500 to 1,700 feet in depth, and show encouraging results.

Important "Do's" and "Don't's" of WIRE ROPE Installation and Care

By || John A. Roeblings Sons Co.
A. Leschen & Sons Rope Co.

WIRE ROPES—Their Installation and Maintenance

By A. J. MORGAN

Chief Engineer, Wire Rope Division
John A. Roebling's Sons Co.

THE handling of wire rope during installation and the maintenance of it and the equipment are of vital importance to the safety and economy of any installation. This is particularly true of mining operations because normal requirements under regular operating conditions are very severe. Heavy loads, high speeds, severe abrasion, extreme conditions of corrosion—all combine to make this field of service most exacting.

Wire rope is actually a piece of machinery, the individual parts of which are manufactured to tolerances as small as one thousandth of an inch. The steel wire from which wire rope is made is one of the most uniform and reliable materials in general use; and the methods of manufacture and fabrication are such as to produce a complete balance between all the component parts.

Considering that wire rope is made up of several strands each of which is composed of many wires, and that these wires and strands all move individually with respect to one another when the rope is flexed, it becomes obvious that this is really a complex mechanism and should be treated as such.

The manufacturer builds his wire ropes to give the safest and most economical service possible, going so far as to fabricate special ropes to meet specific operating conditions. However, even with the very fine materials, equipment and methods of manufacture available today, wire rope still requires proper attention during installation and operation.

The treatment of this subject naturally divides itself into three general

parts: first, maintenance of the equipment; second, installation of the new rope; and third, maintenance of the rope in service.

Maintenance of Equipment

Before a new rope is installed, a thorough inspection of all equipment is very essential. All grooves in the drum, sheaves and rollers which are found to be of incorrect size when checked by the proper groove gauge, should be remachined or replaced. The old rope which is reduced in diameter through wear, may have worn the grooves to a size too small for the new rope. This will cause a pinching or wedging action on the new rope, resulting in excessive and uneven rope wear, rope distortion, wire nicking and crankiness. Grooves may be worn too large through a condition of whipping or vibration of the rope. This is as serious as small grooves, and should be corrected by the same procedure.

If sheave or roller grooves have become worn with corrugations corresponding to the rope lay, this condition should be investigated to determine whether sheaves of larger diameter or harder material are necessary, and replacement made accordingly.

Sheaves or rollers having flat spots in the grooves or worn bearings which permit sheave wobble, should be replaced or repaired. These conditions set up rope vibrations resulting in loss of useful rope life.

Every superintendent and maintenance man should realize that any apparent saving effected by neglect of this part of the maintenance pro-

gram, will actually result in a loss due to shortened rope life and may even be the cause of an accident.

Installation of the New Rope

Since the manufacturer is so careful to establish a definite relationship and proper balance between the component parts of wire rope, it is logical to assume that the user will take precautions to maintain this balance, particularly when it can be done by merely following a few simple rules.

In the case of shaft hoists and slopes, the reel of new rope should be mounted on a substantial cribbing and equipped with suitable brakes. Locate the reel directly in line with the head sheave and drum on the side of the head frame opposite the hoist house. When this is inconvenient, locate the reel under the head frame between the hoist and the shaft, leading the rope directly to the head sheave and avoiding scrubbing and all sharp or reverse bends.

Prevent untwisting of the rope and do not destroy or disturb the wire servings on either end without first putting on others equally as good.

When winding onto the drum maintain as much back-tension as possible on the rope. This applies especially to the dead wraps on the drum because tightly wound dead wraps will better withstand cross-over abuse.

On a grooved drum the rope will naturally take its proper position, but on a plain faced drum it is usually necessary to lightly drive the wraps of the first layer into position during the winding operation. Be careful not to drive the wraps too closely together as this will make the winding pitch so small as to result in excessive scrubbing and abuse to succeeding layers.

When the rope is installed and ready for operation, run it under light load for several trips before starting regular hoisting.

Maintenance of the Rope in Service

Early in the life of a new rope there is a slight reduction in diameter due to embedment of the strands into the hemp center causing a lengthening of the lay and consequent elongation of the rope. This condition becomes evident by apparent crankiness of the rope at the skip end, and is relieved by disconnecting the rope from the skip and removing just enough twist as to restore the rope to its original balance. Be certain to keep this untwisting under control and **NEVER ALLOW THE ROPE TO SPIN FREELY**. The above procedure should be followed at any time a rope be-

comes cranky, although usually it is necessary only a few times during a short period following installation.

In all shaft and haulage installations a fatigue condition of the wires develops as a result of suddenly dampened vibration at the point of attachment to the skip or trip. This appears as broken wires at the entrance to a socket or under a clamp. Because of this it is necessary to cut and reattach at regular intervals, the frequency of which will vary on different installations. Each case requires individual study for establishing a proper schedule.

Many cases of multiple layer drum winding, cutting and reattaching at

the drum end proves very economical. In general, removal of one and one-quarter turns properly distributes the cross-over abuse.

All wire ropes require lubrication. Control of corrosion, preservation of the hemp center, and decrease of internal friction are most effectively obtained by proper application of a good grade of the correct wire rope lubricant at regular intervals.

Years of experience in dealing with wire rope problems in mining service have proved that careful installation and maintenance is an investment which pays dividends through more economical rope life with safety.

Suggestions to the Purchaser and User of Wire Rope

By **WALTER C. RICHARDS**

Engineer
A. Leschen & Sons Rope Co.

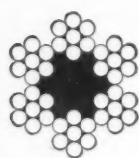
BUYERS of mining equipment and supplies are generally pretty careful these days to select such equipment and supplies that they think are best suited to their conditions. Wire rope might be classified under both of these headings, as it is frequently purchased with the original installation of hoist, conveyor, etc., and then becomes an item of replacement on these machines

and others used in the mining industry.

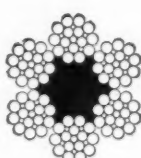
Quite frequently the purchaser is qualified to select the proper rope for any given use, and is able to judge of its quality and workmanship, and the standing of the manufacturer. He probably knows that rope made from acid steel wire possesses the greatest fatigue resisting qualities. He also knows that the best rope is made by

those companies which adhere closely to approved manufacturing practices. He knows that in all ropes the reputable manufacturer sees to it that the wires have been drawn to given specification, the proper material and correct diameter of center selected, so that the strands will be properly supported and spaced, and that a lubricant made particularly for rope use is applied during manufacture.

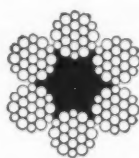
Without having had considerable experience, however, he is not always able to specify the exact strand construction and other specifications that go to make up the rope he should have, especially when confronted with the large number of constructions that appear in most wire rope manufacturers' catalogs. Some of these are shown in the accompanying illustrations.



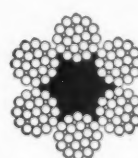
6 x 7



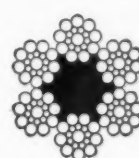
6 x 16
Filler Wire



6 x 19
Warrington

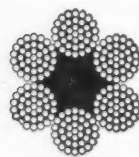


6 x 19
Filler Wire

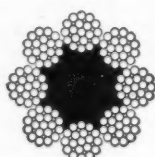


6 x 19
Seale

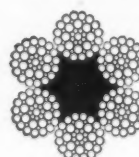
ROUND STRAND



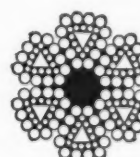
6 x 37
Extra Flexible



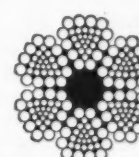
8 x 19
Extra Flexible



6 x 37 Type



Style B



Style G

ROUND STRAND

FLATTENED STRAND

The purchaser usually buys his ropes for a machine already built, or at least designed, so conditions of sheave ratios, reverse bends, groove diameters, etc., are beyond his power to change. The diameter of the rope is generally fixed, and its factor of safety is dependent upon the grade of material of which the rope is made.

Of all the ropes from which a selection must be made, only one, or perhaps two, will give maximum service. Round strand constructions vary from those made up of a few large wires, to those containing a great number of small wires. Those known as 6 x 7, 6 x 19, and 6 x 37 represent the most familiar and basic constructions. In between there are a number of other constructions, made up of different numbers of wires, and many of them, with the exception of the 6 x 7, are subject to a number of variations.

Each construction, designated by the number of main wires in the strand, has been designed to fulfill certain conditions. Those with the large wires are most resistant to wear, but have the least resistance to fatigue, while those with the smaller wires will not stand as much abrasion, but are the most resistant to fatigue. Those with the large wires are used on haulage systems and cableways, and mine inclines, while those at the other end of the scale are used on shovels and crane hoists. Strand constructions lying in between these, proceeding from the large wires to the small wires, are adapted to use on draglines, mine hoists, derricks, clamshells, cranes, etc.

Specifications as to strand constructions must be accompanied by specifications as to the center and the lay of the rope. One of three centers may be selected—hemp center, wire rope center, or metallic core. The wire rope center is a complete wire rope of six strands with its own center, but the metallic core is a single strand made of approximately the same number of wires as the main strands.

Choice of Centers

The choice of centers is influenced by the presence of a condition of intense heat, by the desirability of excess strength, or by the high unit

pressures that are encountered. The hemp center is used for general purpose work. The wire rope center, or metallic core, is of advantage where a number of layers must be wound on a mine hoist or other drum. The ropes with steel center are slightly less flexible than those with hemp center.

The usual rope is made right lay, which means that the strands are twisted to the right, although the wires in the individual strands are twisted to the left. This would also be known as right lay regular lay, as opposed to right lay Lang's Lay in which the wires are twisted in the same direction as the strands. Either one of these could be made left lay by reversing the twisting of the wires in the strands, should occasion require it.

By referring to the illustrations it will be seen that only a comparatively



Right Lay, Regular Lay wire rope



Right Lay, Lang's Lay wire rope

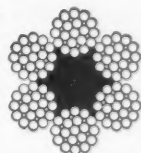
short length of wire is exposed on the outer surface in the case of the regular lay, whereas a considerable length is exposed in the case of the Lang's Lay. This means that the Lang's Lay rope is better able to withstand abrasion, and is therefore used on equipment where this is a serious factor. Right here we might mention that the use of larger wires and a Lang's Lay strand are both recommended to withstand abrasion. Which one of these would be the most serviceable would depend upon the diameter of the sheave or drum on which the rope is to be used, and the comparative diameter of the wires. Those factors operating against the use of Lang's Lay are multiple windings on drums, situations where one end of the rope hangs free a portion of the time, and situations where an extremely heavy load must be lifted on a single part line.

Having selected a rope made according to proper specifications, the seeker of good service also has to give proper consideration to the handling and installation of this rope, and to the proper upkeep of the equipment on which the rope is used. A rope must be properly unreel, or uncoiled, if it is a short rope, to prevent any loops or kinks being thrown into it. It should be carried directly from the reel to the machine, and kept under a slight tension, or should be laid out straight on the ground and pulled into position from there.

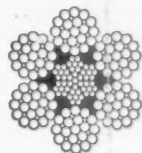
Proper End Attachment

Proper attachment should be made at the ends. If a wedge socket is provided on the machine, reasonable care should be used to see that the strands are gripped evenly, and that no excess strand is forced into the working part of the rope. Manufacturers prepare the ends of the ropes specially where they know on what type of equipment it is to be used, and provision is often made to allow the excess strand to run out at the short end. Sockets are used on many mine hoists, but are often the cause of wires breaking at that point, as a result of vibration. This motion is suddenly stopped at the socket, and fatigues the wires. This is recognized in a number of states, where it is required by law that the sockets be cut off and reattached at certain intervals. A better connection in many cases is by means of a large thimble and clips.

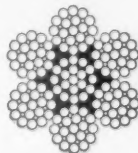
It is hardly necessary to mention that equipment that is out of repair will damage the wire rope and shorten its life. Conditions to be avoided are sheaves with deeply worn grooves, or with grooves that are corrugated, or that have broken flanges; also, sheaves that are out of alignment, due to their own worn bearings or to bent shafts, or other loose bearings. Slack should not be allowed to accumulate in the rope, which will allow it to form loops, and perhaps kink, or where the taking up of the slack will result in severe jerks. Improper drum winding will cause broken wires. This is sometimes due to the fact that the first layer on the drum cannot be put on under the proper tension, or it may be caused by the second or succeeding layers not starting to wind back at the proper point.



Hemp center



Wire rope center



Metallic core

The question of lubrication is also important, and lack of lubrication is frequently the cause of rope failure. The proper lubricant is one that will penetrate to the core, will not run off, and will protect the wires against the action of gases and liquids. With the wires properly coated, friction is reduced, and the corrosive action of attacking substances is retarded.

The above are not necessarily all the points that should receive consideration in the selection and use of wire rope, nor have we given all the reasons why one construction should be favored above another. Each rope

requires special consideration, and if past experience is not sufficient to insure the proper selection, the engineering departments of the manufacturers should be consulted.

The foregoing applies to the various classifications of rope, such as round strand, flattened strand, preformed, and non-preformed, although each one of these has some characteristics peculiar to itself. For instance, a rope of the flattened strand construction presents many more wires on the outside to withstand abrasion, and for that reason in many situations it is the more economical rope to use.

Both the flattened strand and the round strand ropes are now made in the form which is known as preformed rope, which means that the wires are formed into the shape that they will assume in the finished rope, before the final operation of closing the strands into the rope. In this form of rope the broken wires do not project, which makes it an easy rope to handle, and the internal bending stresses have been relieved, which makes it operate more evenly under certain conditions, such as winding on small drums, and less liable to twist, and throw itself into kinks.

Why Specify Pressure Treated Mine Ties and Timbers?

By REAMY JOYCE
District Sales Manager
Wood Preserving Corp.

WE ARE living in a world of changing conditions. Bulk transportation of heavy commodities by rail has resulted in low costs per ton mile. It is difficult to imagine the movement of millions of tons of iron ore from the Mesabi Iron Range to the head of the Great Lakes by any other means than rail at as low a cost. Coal, steel, lumber and hundreds of other commodities are transported safely and quickly from where they are produced to consuming centers. Railroad tracks, bridges, docks and wharves are maintained based on a continuing need for these facilities.

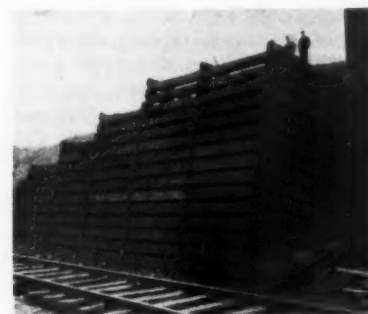
In writing specifications for railroad crossties, the engineers endeavor to balance the amount of creosote retained by the ties after treatment with the mechanical stresses which tend to destroy the wood. It has been demonstrated over a period of many years that decay as a factor of destruction in the life of railroad crossties can be definitely eliminated through modern pressure-preservative methods. Thousands of pressure-creosoted railroad bridges and millions of pressure-creosoted railroad ties are now in serv-

ice after having given from 20 to 30 years of maintenance-free life.

Communication and power companies rate pressure-creosoted yellow pine poles at 35 years, which is the judgment of the engineers in balancing the out-of-pocket current expenditures against the probable development of the present lines.

The mining industry, on the other hand, is constantly faced with the necessity of planning construction and maintenance and selecting materials that will be adequate for a service that often has a relatively short life. Wood for mine timbers, because of its strength and adaptability, has customarily been used for ties, roof support timbers and in many other places in and about mines. In most mining regions, naturally, durable timber is not available, so that there has been a steady increase in the amount of pressure-treated timber used by mines.

Figure 1 shows a pressure-creosoted retaining wall constructed at a mine which had a 15-year life. This timber crib holds an earth bank adjoining the tippie. There were two considerations that resulted in the selection



Creosoted timber crib at Piney Fork No. 1 mine of Hanna Coal Co.

of creosoted oak timber for this particular use. In the first place, there was no available untreated timber that could have been installed that would have produced a life of 15 years under this condition of service. In the second place, there was the possibility that an additional preparation unit might be needed, and if this developed, the new unit would be installed on the ground protected by the cribbing. In the event the new unit is installed, the cribbing can be easily removed and reused. The cost of the cribbing in place was approximately 65 percent of the lightest concrete wall that could have been installed. The concrete wall would have had to be destroyed if the new unit were installed and would not have had any salvage value.

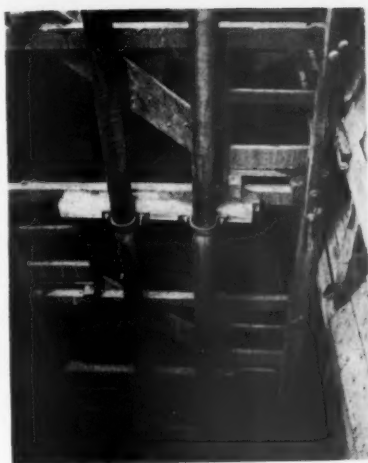


Fig. 2. Creosoted timber stairway in bituminous coal mine airshaft—installed in 1928, photographed in 1939

Figure 2 shows a preframed and bored creosoted timber stairway in an airshaft of a bituminous coal mine. At the time when the photograph was taken, it had been in service for 11 years without any maintenance cost. The life of the mine was estimated at 40 years at the time when the creosoted stairway was installed. There was no untreated durable timber available that could have been used for this purpose without heavy renewal expense during the life of the mine. It is confidently expected that the creosoted timber installation will serve without maintenance expense as long as it is needed. All of this timber was framed and bored before treatment.

Woodworking equipment at a modern creosoting plant is shown in Fig. 3. Timbers are framed and bored to blueprint specifications and are marked for identification before treatment. Where necessary, the timbers are actually erected at the time when the framing is done. The result of this practice has been the elimination of expensive labor on the job and the maximum protection of the timber from the possibility of early failure after installation.

Thirty-three years ago one of the leading railroads installed 24,000 pine ties creosoted with a net retention of

4 lb. of Grade No. 1 oil per cubic foot. These ties have produced an average life of between 24 and 25 years. It is evident from a careful inspection of the ties that have failed that 4 lb. per cubic foot has afforded all of the protection against decay that may be expected from this amount of preservative for periods of service up to 20 years. At the present time, this railroad is using a net retention of 8 lb. per cubic foot, which it is felt will more nearly balance the decay hazard with the mechanical stresses in the tracks.

In one particular bituminous mining operation at the present time, the working sections are in a territory that will be completely exhausted in approximately 5 years. The main headings and air courses are being

ditions of use cannot be salvaged after this portion of the mine is worked out.

This condition does not pertain to main haulage ties underground, which should under all conditions be given a full pressure impregnation of not less than the normal amount of preservative per cubic foot, which for creosote oil is not less than 6 lb. The reason for this normal impregnation with main haulage ties is that when the tracks have served their purpose and the rail is taken up, the pressure-creosoted ties can also be taken up and the spike holes plugged with creosoted plugs, which then makes the material ready for reuse in another location. There are many bituminous coal mines that have had experience with the reclamation and reuse of pressure-creosoted mine ties, and many

Fig. 3. Woodworking mill and framing equipment at modern creosoting plant



timbered as the work is advanced. Untreated timber available at the mine has a life of approximately 2 years. The timber is of an inferior quality and the decay conditions in the mine are severe. A lighter than normal impregnation is now being actively considered for the timber being currently used, with the idea that if one renewal of an untreated timber set can be saved, this saving will more than offset the added cost of the treated material which under the con-

engineers are now definitely specifying main-haulage ties for use under conditions where the life of the tracks is much shorter than the life of the treated ties.

The changing conditions of mine operations with the concentration of work and the rapid extraction of coal due to modern methods has made for changes in the selection of materials, and indicates that the use of pressure-treated material has an important place in modernized mining.

Sayers Heads Committee Studying Toxic Dusts

Dr. R. R. Sayers, one of the vice chairmen of the international committee on silicosis, is chairman of the committee on Standard Allowable Concentrations of Toxic Dusts and Gases of the American Standards Association. This committee is working to determine how much of various gases, vapors, fumes, dusts, or mists may be permitted to remain in the atmosphere

without harmful effect on the workers.

All standards prepared by the ASA committee will first state the scope and purpose of the standard; second, identify the substance chemically, physically, and descriptively; third, state the maximum permissible range of concentrations of the toxic substance in the air of work places; fourth, state how and where atmospheric samples shall be collected; fifth, describe the method or methods to be employed in analyzing air samples;

sixth, include an interpretation and general summary of information to help in applying the requirements.

The committee is now considering a draft standard on carbon monoxide.

ROBERT A. NEAL, formerly assistant to the vice president of the Westinghouse Electric and Manufacturing Company, has been appointed manager of the switchgear division of that company.

Fire and Explosion Protection in and about Coal Mines

UNQUESTIONABLY the two chief hazards to life and property in the coal mining industry are fire and explosions. Progress in general fire protection is not only applicable to fires, but also to the explosion hazard of coal mines, since largely the protection against one is a protection against the other. This article deals with an improved process for extinguishing fires in and about coal mines, which, of course, has a direct bearing on the prevention of explosions. In the underground workings of a coal mine, great care should be taken to eliminate as many sources of methane ignition as is possible. Permissible types of equipment, as approved by the United States Bureau of Mines, should be used wherever it is necessary.

Types of Fires Classified

Class "A" fires pertain to those occurring in carbonaceous materials. This type of fire requires a fast cooling medium. Water has played the major part in controlling fires falling within this group. Within the past year, a relatively new development, known as low-pressure liquid carbon dioxide, has given much promise of efficient protection against Class "A" fires. This medium overcomes many of the objections to water. It is of value where quantities of water discharged on a fire would disturb the roof and result in falls. Hazards and destruction are great because of falling roof where water is applied.

Class "B" fires pertain to those involving paints, lacquers, oils, greases, and other inflammable liquids. In this instance extinguishment should be accomplished by smothering or reducing the oxygen content of the surrounding atmosphere. The common extinguishing mediums are known as carbon dioxide, carbon tetrachloride, and foamite. Oily and greasy machinery are within this classification.

Class "C" fires pertain to those occurring in and about electrical equipment and involve burning insulation and transformer and circuit breaker insulating oils. Fires usually occur in electrical equipment during operation,

and extinguishing mediums that do not conduct electricity must be used. Carbon dioxide and carbon tetrachloride are the mediums usually employed, as they are both non-conductors. Underground electrical substations are within the "C" classification, and they should be protected to prevent spread of fire and possible coal dust explosion.

A fire underground soon grows to be a greater hazard than the immediate fire. If not controlled very soon, ventilation beyond the fire is interrupted and an explosion hazard soon develops. With progress in coal mine mechanization, added hazards from oil, grease, and coal dust have resulted.

Underground electrical substations, wherein one finds m.g. sets and breakers, should be protected to prevent spread of fire. Low-pressure liquid CO₂ lends itself to this type of hazard, as it immediately sets up an inert atmosphere, and it is non-damaging to the expensive electrical equipment. For efficient extinguishment in rooms of this type, the amount of carbon dioxide released should be sufficient to raise the CO₂ in the atmosphere to 42½ percent.

It is possible with low-pressure liquid carbon dioxide to sufficiently dilute a methane-air mixture to render it harmless. As the market for explosion retardant apparatus develops, the fundamental safety factors must receive serious consideration. Any apparatus that is developed for this purpose must be economically feasible, fundamentally sound, and capable of being adapted to a variety of mining conditions. Rock dust is widely used as an explosion retardant. It is used by coating mine surfaces, in barriers and more recently suspended in the manufacturer's paper bag in such manner as to be released by the preceding air blast, the dust having been kept dry and clean.

For fires the problem is somewhat different. The basic type of fire to be

controlled here is one in carbonaceous material. Incipient fire can be controlled with hand portable CO₂ equipment, or a unit discharging rock dust and CO₂ can be used. The deep-seated fire of sizable proportion should be sealed off, and the exhaustion of oxygen plus the products of combustion will effectively extinguish it. However, as a result of fire dying down, the atmosphere back of the seal contracts and causes inbreathing of air. This may prolong the fire, and in order to prevent this, automatic CO₂ valve equipment could be used to inject the gas at the required rate, thus maintaining an inert atmosphere and preventing further combustion.

Properties on the surface present many hazards for consideration. Until recently CO₂ was stored at atmospheric temperature and high pressure. This form of equipment has certain limitations that restrict its usefulness, especially in the mining industry. This industry needed a more convenient form of CO₂, and controlled temperature, low-pressure liquid appeared. This method permits of its storage, transportation, and discharge in bulk quantities that were undreamed of a few years ago.

Surface plants at mines vary, but in general they comprise most of the following: Rescreening plant, coal washery, power house, supply room, machine shop, lamp house, blacksmith shop, fan motor room, and oil and grease storage.

At present it appears that carbon dioxide is a most desirable medium for use in combating fires within these structures. Generally, total flooding, through which a concentration of 42½ percent of carbon dioxide is instantly set up, is satisfactory.

The general planning of CO₂ distribution systems is based on prospective fires of a type characterized by the building construction and content.

This extinguishing agent will not

By **H. ENSMINGER**
Fire Protection Engineer
Cardox Corporation

freeze at any atmospheric temperature, the storage equipment requires no protection from the weather, the stored CO₂ will not deteriorate with age, and recharging is necessary only after a fire emergency.

Low-pressure liquid carbon dioxide

performs a desired service reliably at a reasonable cost and in addition it has the proper economic and technical attributes so far as mining properties are concerned. For the moment, much effort is being expended on its possibilities, on the relative technical merits

of the low-pressure equipment and the principles upon which it functions. Without any doubt, low-pressure liquid CO₂ has unlimited possibilities as an ideal fire and explosion prevention medium for the coal mine operating companies.

Centrifugal PUMPS for Mine Drainage

FOR many generations the massive and costly steam pump had been used for the drainage of mines, but for the past number of years this pump has been replaced by the more portable, small size, compact and lower cost horizontal motor-driven centrifugal pump.

Much has been done within the past few years in perfecting the centrifugal mine pump for handling the noncorrosive and also corrosive acidulous mine waters. The designer has been able to increase greatly pump efficiencies and also reduce the number of internal parts.

It was the custom at one time to use centrifugal pumps which were built with internal balancing discs or balancing plungers. Where the water conditions were such that considerable grit was handled by the pump, the balancing discs or plungers lost their effectiveness and the pumps gave difficulty. The present-day pumps for mine service are now practically all of the double-suction, volute type or the single-suction, opposed-impeller, volute type.

It was realized a number of years ago that by designing a pump with all impellers of the double-suction type, there would be a considerable reduction in maintenance. Each stage of the casing has a spiral volute, and between stages the water flows from one volute into an exceptionally long diffusion nozzle, thence into a long sweep return bend to the inlet passages of the following stages. This construction results in the maximum practical regain of pressure between stages as the liquid is directed along smooth flow lines without sudden changes in velocity. By designing the pump with double-suction impellers for each stage, the difficulty of tremendous axial unbalance has been overcome, and even though the pump should lose its suction, the individual runners which may have lost suction

do not unbalance the pump, as all other runners still remain in balance.

The elimination of high internal thrust on the rotating element has eliminated tremendous pressures acting on the shaft where there may have been slight inaccuracies on the machined parts which constitute part of the rotating element.

For many years it was customary to limit the head per stage of mine pumps handling acid water to about 70 ft. per stage. The tendency is today to operate at much higher heads per stage, and pumps are now being built with heads per stage of 250 to 300 ft.

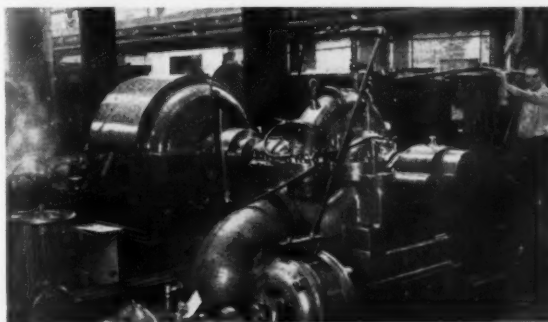
and even higher. Of course, the pumps should be rugged and heavy enough for these conditions and the velocities kept within reasonable limits. These pumps are cheaper in the end, as they are lighter than the low head per stage pumps and more portable. The repairs may be more frequent, but these repairs are less expensive.

Due to the corrosive and erosive action of mine pump waters, it is essential that the volute in the upper half casing match perfectly with the volutes in the lower half casing, in order to prevent any turbulence which

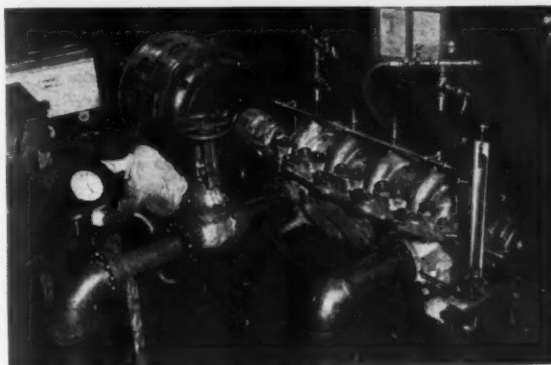
By E. J. BLACKWELL

Engineer-in-Charge
Pump Division
Allis-Chalmers Mfg. Company

16-in. x 14-in.
Type SI
all bronze
mine pump
with 1,000-hp.
motor. Rated
9,000 g.p.m.,
360-ft. head,
1,180 r.p.m.



10-in. x 6-in.
Type MI
4-stage
all bronze
mine pump.
Rated
2,100 g.p.m.,
720-ft. head,
1,760 r.p.m.



may be set up at the main joint casing. It is not sufficient that the casings withstand a test pressure of 50 percent over the working pressure, but there should be metal in addition to allow for additional wear from the erosive waters. The pump casing bolting should also be substantial to prevent any cutting action across stages at the main casing joint. The casing wearing rings should be designed to prevent leakage through the rings from disturbing the flow conditions. Keyways in the shaft which hold the

impellers should be staggered, and there should be no full keyway on the shaft with any differential pressure from the stages across the keyway.

Figure 1 shows a large-size, single-stage, double-suction pump rated 9,000 gallons per minute against a head of 360 ft., operating at a speed of 1,160 r.p.m. and driven by a 1,000-hp. motor. The casing and all internal parts are made of acid-resisting bronze.

A recent examination showed practically no wear on the pump so far. The sump, from which the pump takes

its water, is large, and this helps to settle the heavier material in suspension. It is good practice on any mine pump installation to provide a sump or series of sumps to settle out the suspended material and to prevent agitation as much as possible.

Figure 2 shows a double-suction, multi-stage, solid bronze mine pump rated 2,100 gallons per minute against 720-ft. head, operating at a speed of 1,765 r.p.m. and driven by a 500-hp. motor. Acid-resisting bronze is again used for casing and internal parts.

Antifriction Bearings in Mining

By ROBERT C. BYLER
S K F Industries, Inc.

THIRTY-ONE years ago may be considered as the time when the mining industry entered a new era—the era of antifriction bearings. That was in 1908 when a ball bearing applied to a mine locomotive motor reduced bearing problems more than 60 percent. The original air gap was maintained indefinitely, and electrical troubles such as armature rubbing on pole blocks, armature bonds breaking, tearing of armature coils, etc., became evils of the past.

Mining machinery manufacturers were quick to recognize the power-maintenance - and - lubrication economies of antifriction bearings and began applying them to drills, fans, pumps, cutters, loaders, conveyors, crushers, skip-hoists, screens, coal driers—wherever shafts turned. Eventually, mine operators followed in the manufacturers' wake, and today antifriction bearings are widely used, not only for new machines, but for replacement as well.

To account for this swing to antifriction bearings, it is necessary to compare them with their predecessors, the plain bearings. The frictional characteristics of the conventional plain bearing are due to sliding within the bearing. If the sliding surfaces are not completely separated, the materials comprising the contact surfaces will have considerable influence. If bearing surfaces are completely separated by a film of lubricant, the frictional characteristics are then due to the shearing resistance of the lubricant in the film.

In plain bearings, frictional losses will be least when: (a) lubricant film thickness is least, (b) viscosity is least, (c) contact area is least, (d) contact surfaces are least, and (e) form and dimensions of film are just suitable to the particular operating conditions.

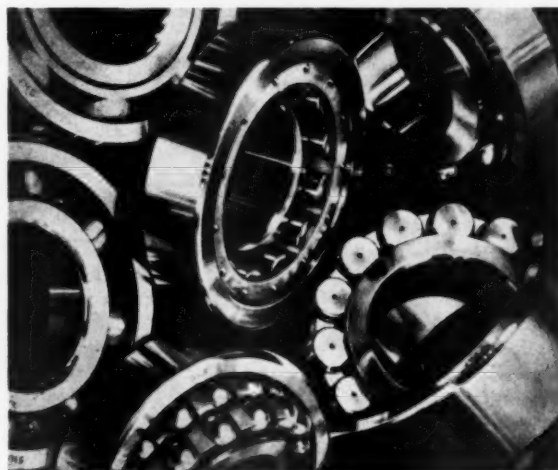
Viscosity of the lubricant depends upon temperature, decreasing rapidly as it rises. Therefore, if the lubricating film is thin, viscosity low, contact area small, and temperature high, the film will be in a critical state and in danger of rupture. Safety requires the opposite of each of the above conditions, so that these bearings can seldom be designed for minimum fric-

tion losses. Lubricant film requires a certain time and speed for its formation, during which wear occurs—thus gradually changing the fit and frictional characteristics.

More stable efficiency can be expected in machines operating for long periods of steady running, such as heavy power plant machinery, than in machines which stop and start frequently. The high starting losses require more power than the running losses, so that they become the criterion for the selection of driving units, which will be, in most cases, larger than for machinery equipped with antifriction bearings.

By comparison, the frictional characteristics of antifriction bearings are essentially due to rolling friction, together with some sliding in contact surface between races and rolling ele-

Antifriction bearings are available in a wide variety of types to meet special conditions



ments and in the retainer or separator pockets. Friction losses will therefore depend upon: (a) conformity of the races with the rolling element, (b) smoothness of surfaces of the races and retainer pockets, (c) internal fit of the bearing, and (d) alteration of internal fits caused by mounting. These features can be controlled closely, so that the antifriction bearing may have inherent frictional stability.

Antifriction bearings generally exhibit their minimum friction after a few hours' run, and will maintain their efficiency throughout life, provided dirt or corrosive materials have not entered to mar the surfaces. Moreover, they consume only slightly greater power for starting than for running, which feature provides the advantage of smaller driving units.

Until a few years ago, the term "antifriction" was regarded by many as synonymous with "power saving." It is a fact that antifriction bearings do save power in varying percentages, depending upon the type of equipment in which they are installed, but this question of power saving has been overshadowed by many other advantages: increased speeds, maximum tonnage, low maintenance and lubricating costs and low costs of handling.

Four types of antifriction bearings commonly used on mining machinery are:

1. The self-aligning ball bearing—a self-contained unit with two rows of balls. The inner surface of the outer race is spherical. Thus this bearing embodies the self-aligning feature which enables it satisfactorily to compensate for the unavoidable conditions of misalignment caused by frame distortion or shaft deflection without impairing its full carrying capacity.

2. The single-row, deep-groove ball bearing designed with deep, uninterrupted, symmetrical races. The curvature of the grooves, conforming closely to the balls, results in large contact areas. This permits the bearing to carry high radial loads. Elimination of the filling slot enables it to carry, in addition, high thrust loads in either direction.

3. The cylindrical roller bearing has a single row of cylindrical rollers guided by flanges on one or both races. Because of its long contact surfaces between rollers and races, this bearing can stand comparatively heavy radial or shock loads and is suitable for operation at high speeds.

4. The spherical roller bearing has the inherent ability of self-alignment, permitting the utilization of its full

capacity under high radial and thrust loads. Its barrel-shaped rollers are so designed that they will remain in permanent contact with the center flanges, assuring positive roller guidance. This bearing has low frictional characteristics.

Such a close relationship exists between the bearing and its housing or other machine part that it is quite natural that as much attention should be devoted to one as the other. Bearings, being a precision product, must be properly housed in order to obtain their maximum advantages. It is therefore essential that the maker of the housing be able to interpret and appreciate fully the importance of the niceties of design as laid out on the blueprint and be qualified to produce it. No one is better able to do this than the manufacturer of antifriction bearings.

Special machine tools, jigs and gauges are essential to the manufacture of precision housings for precision bearings. Such equipment, together with workmen skilled in the art of adhering to close manufacturing limits, insures the accurate fit of the bearing into the housing, the proper type of closure and absolute cleanliness of the casting and component parts.

Applying "Air-Mindedness" to Mining

By || Robinson Ventilating Co.
The Brown-Fayro Co.

The Miner's Greatest FOOD SUPPLY

By ROBERT R. ROBINSON
Robinson Ventilating Company

RECENTLY, people have become more and more air minded. Wherever persons are gathered they talk about air conditioning with about the same degree of comprehension as they have in discussing "Relativity." Few people realize that air has weight, or that enormous quantities of air are necessary to support combustion and to sustain life.

It is not difficult to visualize the burning of a ton of coal an hour in a boiler furnace, but to those not familiar with boiler practice, it would seem unbelievable that approximately 12 tons of air must pass through the fire while that ton of coal is consumed. Thus, a boiler consumes about 12 times as much air by weight as it does coal, and four times as many pounds of air as it does water.

Air Is Food

For man, air is a food, just as much so as any liquid or solid; and it is the only food which he will consume willingly in a polluted state. Man uses from eight to ten times as much air, by weight, as he does liquids and solids combined. A normal man breathes from 30 to 60 lb. of air in 24 hours. Consequently, man gets his greatest quantity of food for nothing, until he goes underground. Then, the maintenance of this food supply becomes expensive, and the machines which maintain the supply should be selected with greatest care. Miners should not consider the process of maintaining their chief food supply

a necessary evil to be installed quickly and cheaply, but should give it more thought and attention than any other problem that arises in mining; man can live many hours without solid or liquid food, but without air, or with poisoned air, he can live only a few minutes.

Therefore, the proper ventilation of a mine is of the utmost importance, and the conditions necessary for correct ventilation must be carefully considered. The mine air passages should be kept large enough to allow the required volume to flow at velocities of not over 800 to 1,000 ft. per minute. Falls of roof slate should be leveled off to prevent sudden changes of velocities, water should be drained out of the airways, and frequent inspection of *all* main airways should be made. Increases in velocities cause rises in pressure and consequently larger power bills than would be the case with uniform velocities. Sharp turns and corners should be avoided for the reasons just given.

In selecting the main fans the following factors, in order of their importance, should be considered:

1. *Durability.*—The most important feature of the fan is its construction. If the machine will not operate without frequent repairs, it is not a safe, or economical fan.

2. *Characteristics.*—The fan should be able to create higher pressures without change of fan speed, as the orifice of passage in the mine is restricted, so that the water gauge will reflect the condition of the airways. The fan should be able to work over a broad range of pressure with good efficiency.

3. *Application.*—The fan size should be selected to suit the history of the mine operation. If it is anticipated that the equivalent orifice of the mine will decrease, the fan should be relatively small, so that when the pressure rises for a given volume and the speed of the fan must be increased, the fan will be operating at the higher speed with better efficiency than it did at the lower speed. Since the power at constant fan efficiency varies as the cube of the speed, it is obvious that the higher speed should be obtained at better efficiencies. Conversely, if the orifice is likely to increase, the fan should be relatively large, so that as the orifice increases, the fan efficiency will be improved.

The accompanying chart illustrates these statements; its use is shown by the following examples:

If the anticipated duty of the fan were 116,000 c.f.m. at 3.10 inches,

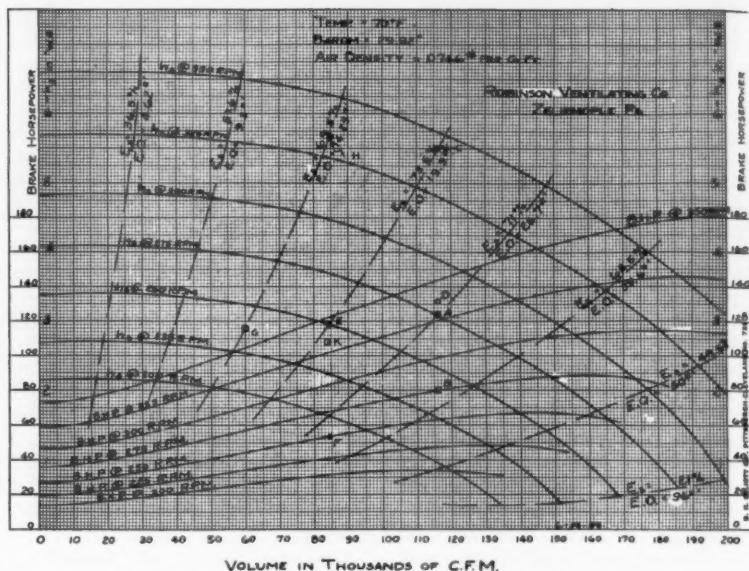


Chart showing important factors in choosing fan size

with an equivalent orifice of 26.7 square feet, and the fan speed 275 r.p.m. (Point A), the efficiency would be 71 percent, requiring 80 horsepower (Point B). This fan would be called small for the work.

If, after a period of time, the mine orifice decreased to 19.9 square feet, the pressure for 116,000 c.f.m. would be 5.50 inches w.g. (Point C). The fan speed would then be 342 r.p.m., but the efficiency would have increased to 73.5 percent, and the power required would be 131 horsepower (Point D), instead of 140 horsepower if the efficiency had remained at 71 percent.

Now, suppose this same fan were to be used for a mine where the anticipated condition was to be 84,500 c.f.m. at 2.95 inches w.g., with an equivalent orifice of 19.9 square feet, r.p.m. of 250, and an efficiency of 73.5 percent (Point E), and the power would be 54 horsepower (Point F).

Assume further that it was discovered that instead of 84,500 c.f.m. at 2.95 inches, 60,000 c.f.m. required 2.90 inches w.g. with an equivalent orifice of 14.25 square feet (Point G), then to obtain 84,500 c.f.m., the pressure required would be 5.67 inches (Point H), the speed would then be 334 r.p.m. and the power 108 brake horsepower (Point K), instead of 102 brake horsepower, if the fan had been of correct size to meet the equivalent orifice of 14.25 square feet.

The chart shows the operation of a type of fan particularly well adapted to change in orifice. Most designs of fans will not meet these conditions, and many fans now in operation consume their value in *wasted* power every year.

No matter how air is carried through the mine, we should always remember that the atmosphere is our greatest food supply and the only one as yet not taxed.

Function of Auxiliary Blowers in Conveyor Mining

By MURRAY W. TUCK

Sales Engineer
The Brown-Fayro Co.

BEFORE the development of mechanical systems of loading coal, it was customary to have only one or two men in a working place, ventilation being accomplished by means of crosscuts provided for this purpose.

Although never very satisfactory, this method was generally used because of the relatively small volume of air required at the face. Where more than this minimum amount was necessary, line brattice was used to increase the flow of air. Mechanical loading, with greater concentration of men and machines, demands better ventilation of the working faces, but to accomplish this by the methods formerly used is

impractical. Brattice requires frequent attention to be kept tight, and it interferes with the movement of men and machines. To get an adequate volume of air it would be necessary in many cases to increase the air velocity in the heading by means of a main ventilating unit of greater size and power.

A simple and cheap way of obtaining proper ventilation is by means of portable tubing blowers, which are now widely used for this purpose. The early application of these units was simply to supplement the regular ventilation systems, but the present trend is toward the elimination of many crosscuts and the use of blowers as the only means of furnishing air. This development involves the use of blowers having greater capacity and pressure, and makes reliability a factor to be considered. Since it is comparatively new, this system is not fully recognized by the present mining laws, but it has been demonstrated that better ventilation and greater safety is obtained at the working faces than could be expected with older methods.

Positive Air Current Supplied Directly to Face

Blowers of this type furnish an ample supply of air where it is needed and provide a positive current at the face, which is particularly important if there is a tendency to generate gas. Fumes from explosives are quickly removed and temperatures due to a concentration of men and machines are reduced, resulting in a general increase in efficiency. An appreciable saving is made by the elimination of many crosscuts and their stoppings which were formerly required only for ventilating purposes. Due to more efficient use of the air and reduction of recirculation, the power required by the main ventilating unit can often be reduced.

Portable blowers are used to advantage in connection with heading development. When two headings are advanced simultaneously the output of one unit can be split so as to ventilate each heading separately, avoiding the necessity of crosscuts other than those regularly provided at 300-ft. intervals. Other uses include ventilation of raises or slopes, also tunnels driven where it is desired to cut through a fault at the minimum expense.

The selection of the proper blower units is dependent upon the volume of air required, the greatest distance between the blower and the face, and the size of air line used. Generally speaking, these blowers can be classified into two sizes. The smaller is suitable for



Model BB tubing blower furnishing ventilation in a coal mine

three to five men, having a capacity of 1,000 to 1,200 cubic feet of air per minute through 300 to 400 feet of tubing, and designed for a maximum shut-off pressure of about 3-in. water gauge. The larger size is for use with groups of five or more men, and has a capacity ranging from 1,500 to 2,000 cubic feet per minute, and a maximum pressure of 5 to 6 inches. Since the greatest load on the blower comes at free discharge, it is desirable to select a unit that is not overloaded under this condition, as there is a possibility of the tubing being pulled loose from the blower outlet, or being ruptured near that point.

Air duct is generally used in 8-, 10-, or 12-in. diameters, and is made of flexible tubing in various grades, or steel pipe in 6- to 10-ft. lengths. Use of duct of adequate size is important since too small a diameter will greatly reduce the blower output. For example, the pressure required to deliver 1,500 cubic feet of air per minute through 100 feet of 12-in. pipe is about $\frac{3}{8}$ -in. water gauge, through 10-in. pipe $1\frac{1}{2}$ inches, and 8-in. pipe $4\frac{1}{2}$ inches. Air ducts 8 inches in diameter should be used only where each line carries but a portion of the blower output, such as where two working places are ventilated by a single unit. For the larger blowers delivering air to a single face, tubing smaller than 12 inches is not recommended.

Location of Blower

The blower should be located at least 15 feet outby from the room neck or crosscut, where it can obtain intake air and there is no possibility of recirculation. Since blowers on the market today are compactly built and readily placed on any available support, there is usually no difficulty in

properly locating the unit. The air duct can be laid on the floor, or supported from the rib or roof. Where flexible tubing is used the latter method is preferable since it is kept out of the dampness, and its own weight when collapsed does not restrict the flow of air. Regardless of the type of duct used, it is important to maintain it in good condition, keep all joints and connections tight, and avoid kinks and sharp bends.

Where blowers cannot be properly located to secure intake air, a short length of tubing can often be connected to the suction side. In some cases it may be desirable to exhaust air from, rather than blow air to, the working face. For such installations the blower is located in the return air, and the pipe is attached to the suction side. Wherever tubing is used for exhausting it must be of non-collapsible construction.

Coal Mine Directory

The National Coal Publications, publishers of *MacQuown's Directory of Coal Operating Companies* advises that the 1939 edition is now ready for distribution.

This directory contains complete description of every active coal mine in the United States, giving full details regarding the equipment outside and inside the mine and personnel. It is guaranteed to contain more accurate, complete, and up-to-date information on the coal mines than is available elsewhere. It can be used to advantage by all companies selling mine supplies and equipment as it also lists the coal producing companies alphabetically by states and cities, showing the location of the main office and name of purchasing agent. An alphabetical list of coal producing companies and mines is also included, making it possible to locate any company or mine with a minimum of effort.

Toward Better PREPARATION and CONCENTRATION

By
Jeffrey Manufacturing Co.
McNally-Pittsburg Mfg. Corp.
Deister Concentrator Co.
American Pulverizer Co.
Denver Equipment Co.

Coal Preparation Related to Increased Use of Mechanical Loading

By GEORGE L. ARMS
Coal Preparation Division
The Jeffrey Manufacturing Co.

THE art of preparing coal for market has had, metaphorically speaking, to gird up its loins and do battle with the many new problems brought about by the use of loading machines. One of the first axioms developed was that the coal would usually be dirtier, and would require some means of mechanical cleaning to make it salable, particularly the slack. The selective loading of coal in the mine, and the consequent elimination of at least a portion of the objectionable foreign matter, became no longer practicable, for a machine should load everything in front of it to secure the greatest possible savings through its use.

Presence of "Rash" Complicates Problem

In addition to the increased use of washing due to mechanical loading, the cleaning problems themselves have developed new phases. It is still the same problem qualitatively, with its solution made more difficult by the increased amount of material to be rejected. One circumstance of this kind which has just recently come to light lends enough emphasis to the foregoing statement to be worthy of special mention. This is the occurrence in the coal from a northern mine of "rash," a very thin, flaky impurity in the smaller sizes. While this washing

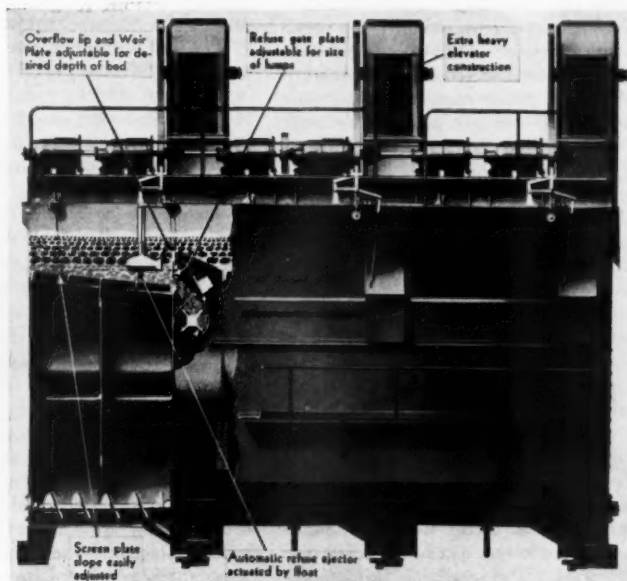
problem has been encountered in one of the southern coal fields, and has been for years the outstanding characteristic of the cleaning problem in that particular field, it had only been sporadically known in the North as a cleaning problem until the advent of mechanical loading. Now the "rash" can no longer be gobbled in the mine and must be dealt with in the cleaning

plant. Similarly, a recent study of some high-capacity washing operations in the Midwest has developed the fact that this same problem is found in that district, and the quantitative increase resulting from the shift to mechanization makes special attention to it absolutely mandatory.

The change to mechanical loading has not only materially increased the amount of dirt to be removed by cleaning, but has made the attainment of good results more difficult because of the volume of refuse material to be removed from the coal. This is true of the underground as well as of the stripping operation, with the result that in many cases the feed to the cleaning plant contains 25 percent or more of reject.

A very natural result is that more

Side view of 3-compartment jig with cutaway sections showing float control and refuse ejector



and more emphasis has become necessary on the facilities for separating and handling the materials rejected by the cleaning process; at the same time, washing performance has had to be scrutinized more closely. Obviously, 5 percent "float" represents much more salable coal if the reject constitutes 25 percent of the feed than if it constitutes only 5 percent. For this reason the trend is toward putting the major emphasis on the percent of feed recovered as salable coal, and to select equipment with a proven record of high efficiency on this basis.

Larger Size Washer Feed

Another significant accompaniment to the trend to mechanical methods has been the increase in the top size of washer feeds. Instead of the orthodox 2½-in. or 3-in. upper limit which prevailed a few years ago, often everything that will pass a 7-in. screen is washed, and washing equipment has had to be modified accordingly. One manufacturing company has found it necessary to increase the size of refuse draws and elevators twice, and with the constantly growing maximum size and increased tonnage being handled by the jig, a third increase seems not unlikely.

Perhaps the most interesting thing in connection with this item has been the development of jigs and jiggling practice to handle this entire range of sizes without prescreening. The significance of this to the operator lies in the fact that it permits of simpler flowsheets with less screening equipment, and consequent lower operating costs.

Also there is the reduction of hand-picking expense secured by low-gravity washing of the larger size in the washer feed. It is now definitely proved that 6- or 7-in. egg coal in a mixed feed may be washed at a markedly lower gravity than the smaller sizes in the same jig, and that the different washing gravities can be readily controlled. Also it has been proved that high efficiencies can be obtained in the different size fractions of the feed. This operating technique in which the coarse sizes are cleaned at 1.45 specific gravity, for example, and the successively smaller sizes at high specific gravities makes possible effective cleaning of the coarse sizes where appearance is the prime factor and maximum realization on the smaller sizes where percentages of ash and sulphur determine salability.

In planning for a cleaning plant installation, the character of the coal to be washed must be carefully studied. Roughly speaking, the true separation

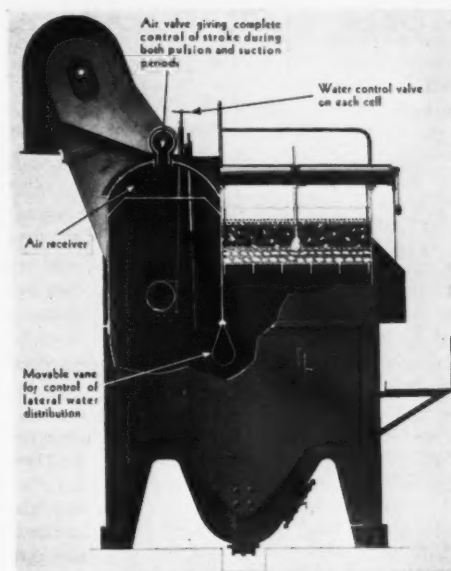
problem is presented by the contents of the seam itself with nothing excluded. In selecting washing equipment, care must be taken to secure the proper type to make an accurate separation of the kind of coal presented by the seam, and at the same time to have the capacity to separate and handle a large amount of extraneous material that will no longer be gobbled in the mine.

Increasing Need for Versatile Units

The fact that mining methods are, so to speak, in a state of flux, lends importance to need for ample ways of adjusting the different functions of the jig. The popularity of the air-operated or Baum-type unit is traceable to the readiness with which it may be adapted to varying conditions of operation. The accompanying illustrations show the many ways in which one standard machine may be adjusted to meet varying field conditions. Jigs of the type shown have proven to be capable of handling 7 x 0-in. coal at rates up to 400 tons per hour, with every evidence of complete control of the washing through the entire size range. They have shown high efficiencies, operating with a small fraction of 1 percent of loss of the "float" in the refuse even when handling such high tonnages. Moreover, there is evidence that capacities can go still higher, for important recent discoveries in the relationship between speed and special types of jig strokes have resulted in notable increases in the capacity and in the efficiency of these jigs.

Piano-wire Screens Being Introduced

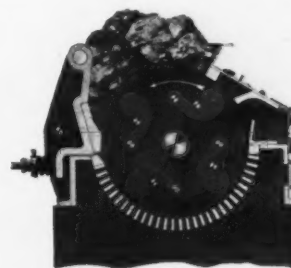
In the instances where an operator wishes to screen out the fines or dedust his coal before washing, the development of screen cloth made of piano wire and stretched to a high tension promises to eliminate many of the difficulties that have beset this operation. This new wire cloth—unusual in that the wires run in one direction only, no cross wires—is stretched to such a



End view of jig with portion cut away to show air receiver, pulsion chamber and coal washing compartment

high tension that the individual wires develop a resonance which imparts the peculiar property of passing undersize particles much more rapidly than the conventional types of cloth. It is also claimed that this piano wire has much greater capacity, longer life, and almost complete freedom from blinding.

The increase in the top size being handled through washers brings with it the need for recirculating and crushing a middlings product to avoid loss of coal. Crushers for this service should not make an undue percentage



Sectional view of Flextooth crusher

of fines. The new slope speed flex-tooth crusher or hammermill seems to fit this service admirably, as middlings always contain a certain amount of harder and more refractory material than the coal itself. The tendency of such a machine is to leave these pieces in the larger sizes, thus making the separation in the jig easier.

STOKER COAL PREPARATION

By R. L. PATE

McNally-Pittsburg Mfg. Corp.

IT IS assumed that most of the readers of this publication hope to see coal remain as king of the fuels, and this article attempts to present a few constructive comments that may lead to better coal preparation. The modern coal operator has, with some assistance from the equipment manufacturer, solved, most every problem he has encountered, but in this rapidly progressing world there are still one or two items on his list that have been worrying him.

Stoker-coal preparation and the drying of the washed stoker sizes seem to have the floor at the present moment. The salvation of the coal industry depends largely upon educating the public to the use of stokers. Modern people are too practical-minded to buy 18-in. by 18-in. lump coal when their furnace doors are only 12 in. by 15 in. Few of us enjoy spending part of the breakfast hour using a pick and sledge on a 24-in. chunk, and then maybe finding a "nigger head" in the center of it. Coal is safer to use and more economical than other fuels, but must be used in a stoker if it is to offer the fuel satisfaction demanded by the public today.

The stoker manufacturers have certainly done their part in making coal burning a pleasure, and the coal operators likewise have done and are doing their part.

Hints on Drying

The washing of coal is no longer a problem, but the drying has been until recently. With this in mind, the best solution of the problem is to wash, say, 7-in. by 0-in. in one or more boxes, according to the findings of the washability investigation, and dry the ¾-in. by ½-mm., discarding the ½-mm. by 0-in. which is usually objectionable on the grounds of causing excessive fly ash, and that naturally is difficult, but not impossible, to dry.

It has been proven that the ¾-in. by ½-mm. is all that it is necessary to dry under most marketing conditions. The ¾-in. plus will be sufficiently dry at destination with ordinary screen dewatering. Dried ¾-in. by ½-mm. coal will mix satisfactorily with ¾-in. plus sizes, but dried 5/16-in. by ½-mm. coal mixed

with wet ¾-in. by 5/16-in. coal will freeze in railroad cars under extremely cold temperatures. This is the point that determines the top size for drying in most cases.

The centrifugal type of dryer is frequently satisfactory for ¾-in. by 0-in. coal where the weather is not too severe and degradation is not too objectionable. It is impractical to put coal larger than ¾ in. into this type of dryer due to the excessive amount of degradation made. This also applies to the rotary kiln type of dryer. Good stoker coal should not have an excessive amount of fines; therefore, when a coal is down to stoker size it should not be further degraded.

Developments in Crushing

When the normal percentage of stoker sizes from the run of mine is insufficient for the stoker coal requirements, it is necessary to reduce some of the less desirable larger coal to stoker sizes, preferably after washing. The latest development in stoker coal crushing is the adjustable double-roll cone-tooth crusher. This machine produces a minimum of fines, which after all is one efficiency test of a stoker coal crusher. The cone-tooth crusher has proven that it can crush 3-in. by 1-in. coal to ¾-in. by 0-in. with from 7 to 20 percent of ¼-in. by 0-in., this being determined by the amount of oversize allowed to recirculate. The horsepower required to operate this type of crusher is approximately 50 percent of that used by other types and its cost is also much less than that of any other unit doing a comparable job.

The stoker coal made by crushing

does not need drying, but the ¾-in. by ½-mm. washed coal of the natural run of mine is likely to have a free moisture content of about 13 percent after leaving the dewatering screen.

To dry this coal down to any reasonable moisture content above its fixed or inherent moisture, without making further excessive degradation and at a minimum cost, is quite simple, providing the correct type of dryer is selected. We have installed rotary kiln dryers, centrifugal dryers, and the shaking screen type dryer with flue gas and hot air being drawn through the coal bed by an exhaust fan with a pulsator for giving an impulse to the bed of coal on the screen. This pulsator is nothing more than a rotary or louvre valve that shuts the suction on and off, thereby causing the impulse. This type of dryer will accomplish everything that even the combination of the centrifugal and rotary kiln types will do, and in addition will not make excessive degradation.

An actual field test at the mine of the Binkley Mining Co. of Missouri, at Keota, Mo., demonstrated that by operating the dryers on a cold-air basis, approximately 50 percent of the drying necessary at that plant was done mechanically. This test proved that this type of dryer accomplishes in effect the same thing that a centrifugal dryer does and in addition, when the heat is applied, will take the place of the kiln type dryer. In other words, it is a two-in-one unit.

These dryers are drying ¾-in. by ½-mm. coal at Binkley, and the amount of water removed from the coal to the dryers is 13 percent. Since half of this is done mechanically, the heat-drying problem is quite simple and the evaporation requirements very low. The furnace temperature is held at about 700° F. The drying-chamber temperature is thermostatically controlled, thereby insuring the uniform moisture content of the finished product. The coal remains in the dryer for a period of only 40 seconds.

Improvements in Table Construction Continue

By DON A. WEBER

General Manager
The Deister Concentrator Co.

THERE is a tendency today in the field of wet washing of coal to expect more and more from the coal-washing table. These requirements take the form of interest in cleaning increasingly finer sizes (No. 5 buck, perhaps No. 6 buck anthracite, and as fine as minus 48-mesh bituminous),

and in problems of handling feeds of wide size brackets, containing extreme fines along with a spread of sizes up to considerably coarser particles.

These conditions demand the smoothest possible operation of the table deck, or cleaning surface, without even the usually imperceptible vibrations sometimes occurring in the surface of the deck. Recognizing that deck flutter and uneven deck action are serious contributing factors to poor cleaning performance and lower capacity, operators see to it that their coal-washing table equipment has adequate provision for rigid deck support when this is not furnished in the machines themselves.

"Backbone" underconstruction, including an all-steel sub-frame and main channel base, has been an important feature in Deister-Overstrom coal-washing tables for many years.

While such makeshift arrangements as extra bracing and blocking between slipper bearings and the floor of the washer building have never been associated with installations of this type of table because of this main frame, the structural steel sub-frame and its out-board corner supports; nevertheless, the manufacturers in continued efforts to build coal-washing table equipment insuring not only the highest degree

of cleaning efficiency but also lowest installation and operating costs to operator, are introducing an even superior construction. A new type of table has recently been introduced, offering heavy-duty underconstruction with heavy-duty rocker arms, even more rigid all-steel, all-factory aligned sub-frame and heavy main channel, contributing to the highest type of cleaning results. At the same time the operator is saved the expense and responsibility of expensive and troublesome work in supplying complicated foundations, bracings and blockings, with expert attention for properly lining up the equipment.

Integrally mounted on extended table main channel, thus obviating necessity for expensive separate mounting pier, this table is powered by a new type of anti-friction bearing head motion. While providing the same mechanical simplicity and trouble-free features which have characterized the running-in-oil motion, the new motion offers even more rugged and compact design. It is equipped with heavy SKF anti-friction self-aligning bearings. It is smooth

and quiet in operation, and has shown by tests to require less power to start, and somewhat less power to run, than is possible with other types of motions. Its greater "kick" insures handling of larger tonnages.

The new table is furnished with either tight or loose pulleys for belt drive, or with complete V-flat drive mounted on an extension of the table main channels, making the drive assembly an integral part of the machine.

The deck on the new table is popularly provided with colortype highest grade one-piece rubber cover, homogeneous and homochromous throughout its entire composition. The use of the one-piece cover insures a smooth operating surface and protection against leakage of water to deck through splicing of cover. Riffles are of high-quality rubber and are cemented to the rubber cover by an exclusive technique. Cementing the riffles further insures smooth operating performance because the cemented-on riffles represent straight, true lines without the slightly wavy effect resulting when riffles are attached by nailing.

Meeting Specific CRUSHING PROBLEMS

By HENRY GRIESEDIECK

Vice President
American Pulverizer Co.

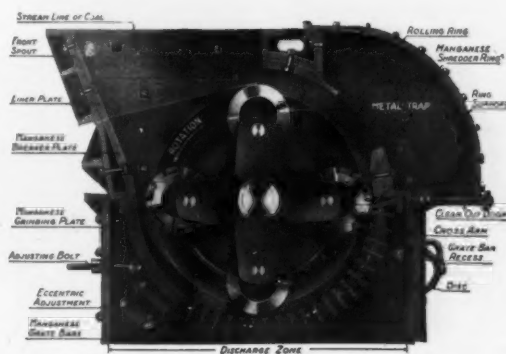
THE preparation of coal for marketing today is a highly complicated problem requiring constant study and attention. Engineers have made rapid strides for industry in producing power and heating. They have found that preparation and sizing of coal are vital factors in the efficiency of the power or heating plant. Hand-fired boilers are rapidly becoming a relic of the past. To meet the requirements of the changing demand resulting from the improvements in coal-burning plants, the coal operator has had to be on the alert.

The American Pulverizer Co. has been in business over 30 years, servicing the coal industry, and has watched these improvements develop. Its responsibility has been one of service, and it has, therefore, had to study intensively with the coal operator the changing demands of the consuming

public in order to meet efficiently the marketing problems of the industry. During this period engineers have been constantly at work adding to and improving equipment. Progress has been

made, and today crushers are available that will produce a large range of sizes with a minimum amount of degradation at a low cost for a variety of special purposes.

Crushers must necessarily be rugged in construction and built of the best material with a view of having the crushing parts readily accessible for inspection and adjustment. The feed enters at the top and is rolled by rings in a downward movement against the breaker plate, where the primary reduction takes place. The final reduction is performed against the ad-



Sectional view showing action of ring coal crusher

justable grinding plate, and any oversize is eliminated in the sizing chamber by grate bars or screen plates. The rings in the crusher are of unique design to revolve at slow speed and are built with the idea of splitting the coal instead of shattering it by impact.

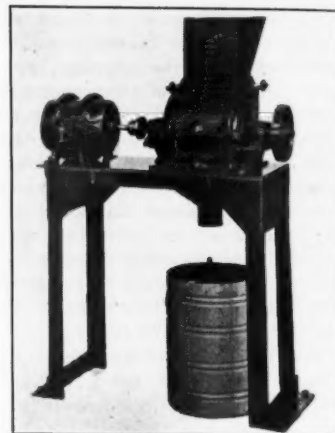
The specific problem of the individual operator or industry is met as it arises. For example, in one instance coal is reduced efficiently from run of mine to a 3/4-in. stoker product where the latter is in demand. A cross-sectional view of this type of crusher is shown in the adjoining illustration. Industrial power plants and central stations are using it for crushing to a uniform product the various sizes bought in the open market in preparation for burning in stokers or pulverizing. Surplus egg and nut are crushed to domestic stoker products with minimum degradation in another instance. The crusher used in this case has a double adjustment for controlling the size of the product to meet the flexibility of the modern preparation plant. Different sizes can be obtained by adjusting the crusher while in operation. There is no shut-down of the plant and no concentration of extra labor necessary to make the change.

Another operation requires a crusher for reducing middlings originating in

a washery. Middlings run high in impurities and must be crushed to a fine degree to free the good coal. The middlings are contaminated with a foreign substance and saturated with water. The crusher is kept clean by forcing additional water through it while in operation. In a special case a crusher is used to reduce the refuse to free the good coal that clings to the impurities. The modern operator avoids waste and recovers the maximum saleable product that is hoisted out of his mine.

With still another operation impurities become by-products. The crusher breaks up the impurities, and pyrite is recovered from the crushed refuse in sufficient quantity to become marketable. The pyrite must be crushed sufficiently fine to make a good separation. It is extremely tough material and requires a sturdy and rugged reduction unit.

In a further instance, where coal is sold on specification and a thorough knowledge of the product is required, a laboratory-type ring mill is used for reducing the clean coal as it comes from the washery in preparation for analysis. This small crusher is similar in construction to the larger units and is designed for ease in moving about the plant and to economize in space. The complete unit is shown in the



Laboratory type ring mill

accompanying illustration, mounted on a structural-steel stand.

All these crushers are designed to give constant and continuous operation. The rotating parts are manganese steel, and bearings are the anti-friction type. The crushers are designed and built to pass tramp metal, such as fishplates, bolts or cutter bits, without injury, as the flexibility of the rolling ring system protects the crusher from damage by foreign material.

CRUSHING and SAMPLING of Ore Between Mine and Mill

By FRANK E. SHEPARD

Mechanical Engineer
Denver Equipment Company

PRELIMINARY crushing operations and accurate determination of values on any ore or material are important factors for improved efficiency in the various processes of ore treatment. Earlier methods employed only crushing followed by amalgamation and later the use of gravity concentration devices, but with the introduction of cyanide and flotation processes it became necessary to reduce the material to much finer sizes of particles, involving the use of primary and intermediate crushers followed by the final grinding in ball mills.

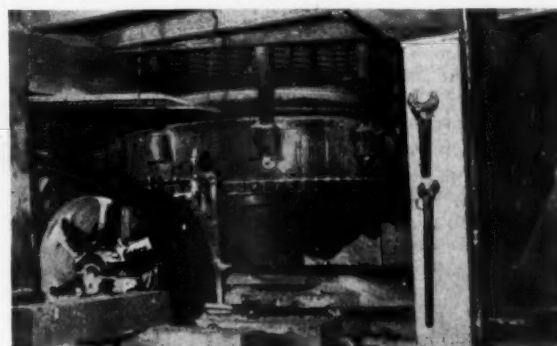
In early installations of the ball mill the size of ore fed to the mills was as coarse as 2 or 2 1/2 in. diameter, which imposed a heavy duty on one unit of the crushing series. Practice soon changed in ball-mill operations, pro-

viding for a much smaller size of ore fed to the mill, resulting in a marked increase in capacity for the same horsepower expended.

Preliminary Crushers

With the introduction of the flotation process, requiring the final grinding of ores to a product of 48 mesh, or finer, and the cyanide process which requires ore pulps ground as fine as 100 or 200 mesh; also with the need of providing smaller sizes of feed particles to the ball mill for improved

One type of
gyratory
crusher



efficiency in the final grinding operations; there was developed a series of preliminary crushing units which reduced the ore from run-of-mine sizes down to the most efficient sizes of feed particles to the ball mill.

Such preliminary crushers are designed to reduce the run-of-mine sizes of ore in two or three stages down to suitable sizes of feed particles for the ball mill.

Primary crushers of the gyratory type have crushing capacities of 20 to 400 tons per hour, with feed openings from 7 in. by 35 in. up to 25 in. by 106 in.

The size of product varies from 1 in. diameter, requiring 15-20 hp., for the smaller sizes, up to 4½-in. diameter, requiring 100-125 hp., for the larger sizes. Much larger sizes of gyratory crushers are manufactured for large-capacity installations.

Reduction or intermediate crushers are used to reduce the crushed product from gyratory crushers down to a crushed product from ⅞ in. diameter, for the smaller sizes, requiring about 20 hp., up to 1⅞ in. diameter, requiring 100 hp. for the larger sizes.

Fine crushers use the principle of the gyrating cone for the crushing stage previous to the delivery of feed to the ball mill for the final grinding operations. Feed openings in this type of fine crusher vary from 3 to 7 in. wide. The crushed product varies from ⅞ in. diameter to about 1½ in. diameter, requiring 25 hp. for the smaller sizes up to 125 hp. for the larger sizes.

Jaw Crushers

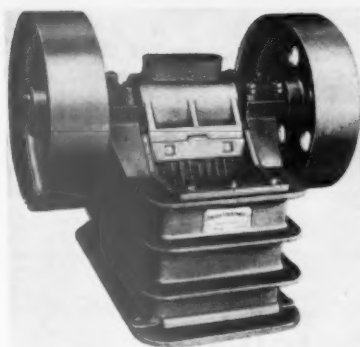
For ore treatment plants of smaller capacity jaw crushers are used to reduce run-of-mine sizes of ore down to feed sizes for the ball mill in one single stage crushing operation. Jaw openings vary from 5 in. by 6 in., requiring 5 hp. for the smaller sizes, up to 15 in. by 36 in., requiring 50 hp. for the larger sizes.

Capacities vary from 5 tons up to 220 tons of ore crushed in 10 hours. Sizes of crushed product vary from ½ in. to 1 in. or 1½ in. diameters.

For crushing plants of large capacity it is proved that crushing ore in two or three stages previous to mill treatment reduces costs of operation and increases the life of wearing parts as well as the operating period.

Sampling of Ores

A very important factor in successful mill operations is accurate knowl-



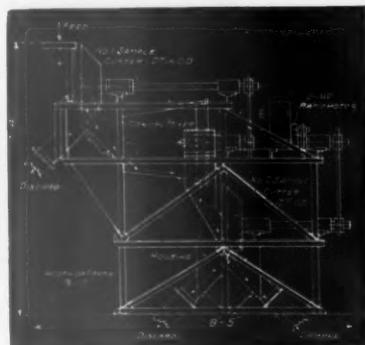
Jaw crushers may be used in small plants to reduce ore to ball mill feed size in one stage

edge of the mineral values delivered to the mill for treatment; of equal import are data on sources of recovery or loss in the different stages of the mill circuit and the loss of values contained in the tailing discharged from the mill.

Formerly, hand-sampling methods were used, either by means of a shovel throwing every fifth, tenth or twentieth shovelful to the sample pile, or the coning and quartering method.

To remove the errors of personal equation, however, automatic ore samplers are now used to produce an ore sample which is representative of the actual values contained in the ore. Earlier automatic ore sampling plants made the first sample cut on ore pieces as coarse as 1½ or 2 in. in diameter. In high-grade ores or where the mineral values are irregularly disseminated throughout the mass of ore, such sampling of coarse pieces may prove misleading, but with the crushing equipment now available, ores may be crushed into pieces as small as ½ in. or ⅜ in. diameters. This allows the first sample cut to be made on smaller pieces of ore which yield a more accurate sample of values contained in the ore body.

The Brunton oscillating time sampler was very accurate, particularly in



Ore sampling unit consisting of two Snyder ore samplers with conical mixer between

the sampling of high-grade ores or ores of varying composition. These samplers were used in Taylor & Brunton ore-sampling plants installed in several western mining districts as well as in foreign ore-sampling plants. The Brunton system of ore sampling included five oscillating samplers with crushing rolls between the samplers so that the first sample cut would be recrushed before the sample cut was made in the next sampler of the series.

During this same period the Snyder and Vezin types of ore samplers were developed. These samplers are of the rotating type and are now recognized standards for accurate sampling of ores.

The typical arrangement of a highly efficient ore-sampling plant is to have sampler No. 1 make a sample cut of from 5 to 20 percent of the original stream of ore between the crushing plant and the mill feed bin; the larger percentage of sample cut being made on high-grade ores or ores of varying composition.

This first sample cut is then recrushed to one-fourth the diameter of the original size of ore before the next sample cut of 5 or 10 percent is made by sampler No. 2.

To save complication of machinery and equipment, No. 2 and No. 3 samplers are arranged with conical, rotating mixing barrel in one compact structural-steel frame, so that the sample from No. 2 sampler is thoroughly mixed before the next sample cut is made in sampler No. 3. This unit saves considerable floor space and headroom, which are important factors in any ore-treatment plant.

Wet Pulp Samplers

Automatic wet pulp samplers are available for determining values at any point of the mill circuit, and are also used for sampling fine sizes of dry ores. The mechanism provides for the sampling of pulps at predetermined time intervals. This device is particularly valuable in determining the efficiency of the different departments of the mill circuit, also for correcting adjustments of machinery and equipment for increased recovery of values.

Economic Importance of Ore Sampling

The development of a mine requires constant investigations on the values contained in ore bodies, the trend of mineral veins and the creation of ore reserves; so in the treatment of its

ores it is of vital importance to know the value and composition of the ores being delivered to the mill circuit.

Accurate and automatic sampling of ores is therefore essential to insure the highest possible recovery of mineral values.

The general arrangement of the ore-

treatment plant, sizes of machinery units and equipment and the cycle of operations are determined from samples of ore obtained at the beginning of mining operations. As excavation progresses, the character and composition of the ore may change and the continuous sampling of ores will indi-

cate the necessary readjustments of the mill equipment.

Ultimate recovery of mineral values can be reached only through exact knowledge of ore conditions or changes, and this makes imperative the use of efficient ore-sampling equipment.

FIELD WAREHOUSING

a Modern Instrument of Credit

By Douglas-Guardian Warehouse Corporation

THERE is nothing mysterious about field warehousing or a field warehouse. It is nothing more or less than a public warehouse that goes to the merchandise, instead of having the merchandise come to it. The merchandise is actually and legally placed under the custodianship of a bona fide field warehouse company, who are merely public warehousemen under another name. Through the use of a field warehouse, a manufacturer or distributor owning inventory can secure the advantages of warehouse receipts in raising needed capital.

The principle of field warehousing recognizes the basic fact that active paid-for inventory represents money in a form practically as liquid as funds in bonds or even in a checking account. Its function is to release frozen funds and put them back into productive work.

If merchandise is stored in a private storeroom at the factory, or in a privately operated warehouse, its collateral value amounts to nothing. In order to become liquid assets, the custody of merchandise must be removed from the possession of the manufacturer, processor, or producer and transferred to a bona fide warehouseman—a person lawfully engaged in the business of storing goods for profit.

The procedure is very simple. A recognized field warehouse company is called in. To them is leased the premises in which the goods are stored. Signs are posted stating that the merchandise so designated is under the

control of the field warehouse company. The lease is recorded at the courthouse, with full legal description, and usually accompanied by a plat giving full dimensions of the space, and completely identifying the property under lease.

The field warehousing company sends a competent representative to "set up" the warehouse; sees that the space is properly segregated and that ample signs are posted to assure complete notification to the public. He has the lease recorded and instructs the bonded custodian as to his duties. For this custodian service, an employee of the owner may be hired, if he can qualify. In any event, the custodian is put under contract with the warehousing company and his full salary is paid by them. He is placed under bond and given responsibility for the custody of the goods.

Upon the completion of the segregation and the deposit of a signed application for storage of the goods by the storing company, the warehouse company issues warehouse receipts in full accordance with the Uniform Warehouse Receipts Act. The receipts are issued either negotiable or non-negotiable as directed and are then available to the storing company to be used as collateral security as needed.

Field warehousing was used more or less as an emergency financing medium until about 10 years ago, at which time it was estimated there were only 300 field warehouse set-ups. It started largely with agricultural commodities,

but since has been adopted by some 600 different classifications of industry. It is particularly well liked by manufacturers whose annual production is completed within a few months each year.

Field warehousing is a most flexible adaptation of the business of warehousing greatly expanding its utility and scope. Logs in an inaccessible back-woods location, mined coal in storage, at the mine; bars of iron processed but not sold obviously would not be practical commodities for metropolitan warehousing, but are ideal for a field warehousing set-up.

In these days, when banks have a strong liquidity complex, field warehousing is constantly growing in favor as a method of financing both with the borrower and his bank. Borrowers who used to find their unsecured notes accepted at the banks are being asked by the bank to segregate raw or finished materials available as collateral and are calling in reputable field warehousemen to handle the operation.

STANLEY MICHAELSON, engineer in the mining division of Allis-Chalmers Mfg. Co., Milwaukee, Wis., has been transferred to the Salt Lake City district office where he assumed his duties May 1 as sales engineer specializing in mining and related machinery built by the company. Mr. Michaelson has been with Allis-Chalmers since 1935, previous to which he was on the faculty of the mining department at Lehigh University.

Making Mining A SAFER OCCUPATION

By || Mine Safety Appliances Co.
Portable Lamp & Equipment Co.

Recent Improvements in Design of

Mining Safety Equipment

By J. T. RYAN

President and General Manager
Mine Safety Appliances Company

IN THEIR effort to improve and make safe the work of the miner, safety equipment manufacturers conduct a continuous research in their laboratories and in the field for new products and for means of improving their present products. When a new or improved product is released from the laboratory, it is sent into the field for tests under actual working conditions. If proven satisfactory, it is then released for general use.

Present-day mining methods are the result of years of experience and operators are slow to adopt new methods or equipment unless they have some assurance of their practicability.

The new Model P Edison electric cap lamp has been in the process of development for more than five years, and during this time has been used in the field for more than three years. When it was found that some feature was not satisfactory for actual use, the lamp was returned to the laboratory for redesign. The result of this painstaking care on the part of the manufacturer is a lamp which not only gives more and better light but is also lighter in weight, both in the headpiece and the battery.

No one is more dependent on artificial light than the miner, and every effort has been made in designing this new model to prevent a lamp failure underground. To reduce the weight of the headpiece it was made smaller, and, of course, this necessitated a smaller bulb. It was at first thought that this would mean a single-filament bulb, but the laboratory came forward with a parallel filament, krypton-filled

bulb, which has both filaments burning at the same time. To overcome any possibility of both filaments burning out during the same shift, one filament is designed with a life of 300 hours and the other with a life of 450 hours. The use of krypton, an extremely rare gas, in place of argon increased the efficiency of the bulb with the same wattage by about 20 percent.

By using the smaller bulb, and end-on mounting of this bulb, it was possible to increase the percentage of the area of the reflector available for reflecting light. In addition, the aluminum reflector has been chemically treated to improve the reflecting surface. The final result of these changes in the bulb and reflector design is an increase of approximately 28 percent in useful light output.

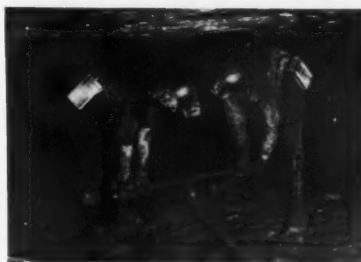
As, heretofore, lens breakage being an important item in the use of the electric cap lamp, it was decided to increase the thickness of the lens. The increase in thickness, augmented by the smaller diameter, increased the strength of the lens materially. This increase in thickness was found to have a negligible effect on the absorption of light.

To overcome seepage of moisture and dust into the headpiece, the conventional flat rubber gasket has been eliminated and a U-shaped gasket substituted. This has been very satisfactory, even under trying conditions, and, in addition, has helped reduce lens breakage.

Beryllium copper has been used in place of steel for all metal parts of

the headpiece carrying current, to avoid corrosion and rust which may cause flickering.

By using neoprene, a synthetic rubber, for the outside jacket, the cable is no longer affected by oil, and it has been possible to reduce its diameter



Electric cap lamps and safety clothing have been a boon to safer mining

and also the weight to a slight degree. A considerable improvement in cable service life has resulted from impregnating the end of the cable near the battery with a resin to prevent absorption of electrolyte.

The cable protector spring used on previous models has been replaced by one made of neoprene of sufficient length to permit the lamphouse attendant and the miner to pick up the lamp by the cable protector rather than by the cable itself.

Lighter Battery Construction

To obtain a lighter battery and yet retain in it the same electrical properties, it was decided that instead of having each cell in a metal can insulated from the other cells by a rubber sack, and all three cells enclosed in a metal container, the cell itself would be placed in a rubber sack, which in turn would be confined in a stainless-steel container. Each cell is completely partitioned from the next one, although all three are rigidly fitted together and spot-welded into place. These cells may be completely serviced and repaired in the field.

We have attempted to describe here the improvements that have been made in a product now in use for more than

25 years. Let us also consider some of the newer products that detect or improve hazardous conditions.

Among these is a small instrument, no larger than a pocket camera, for detecting concentrations of methane in air. The instrument reads directly in percent of methane up to 4 percent. It is simply operated and can be used by any average workman. It is not intended to supplant the larger, more accurate instrument for the study of mine ventilation, but it is useful as an auxiliary instrument to enable work crews to detect the development of a methane hazard more positively than with a flame safety lamp. Samples may be taken closer to the roof, ribs, bottom, and in recesses in the face or wall, than with the flame safety lamp, as the sampling line or sampling intake can be placed directly at any point desired.

Another new product that is a great improvement on the many present

makeshift devices is a trolley-wire guard hanger. Most states require that the trolley wire, where men work or are required to walk, be protected in some manner. Previously this has been done by wooden boards on each side of the wire or by rubber sheeting slung over the wire. This new device makes use of two narrow strips of rubber sheeting which are hung on each side of the wire, but which are suspended far enough away from the wire so that they are not touched by the trolley pole or shoe. There is sufficient overlap hanging down that the wire is fully protected at all times. With this new device, operators are guarding the entire length of underground trolley, although they are not required by law to do so.

The new midget dust-sampling instrument overcomes the main disadvantages of the regular - size impinger—its bulb, weight, and power requirements—and yet retains the

characteristics which yield essentially the same accuracy. When used with auxiliary microscopes and projectors, it is now possible for mine operators to conduct their own surveys of the dustiness of working places in the mines. This new device requires only the operation of a hand-cranked pump and can be used in a relatively confined space.

Within the last few years, we have seen protective hats and caps, goggles, and safety shoes generally adopted as fundamental safety equipment underground. With continued research on the part of the manufacturers, and continued interest on the part of the operators, the next few years should bring continued improvement in safety equipment and we should see a much greater reduction in fatal accidents and a tremendous decrease in non-fatal accidents.

Combating the Haulage Hazards in Coal Mines

By WILLIAM K. WILBUR

Vice President
Portable Lamp & Equipment Company

EVERY accident that occurs in the coal mines of this country happens under the direct supervision of some foreman. Responsibility of preventing accidents by the application of the best available safety devices goes hand in hand with the responsibility of supervision.

Those who ride the haulage trips are engaged in one of the two most hazardous occupations in coal mining. Quoting the Director of the Department of Mines of one of the largest coal producing states, "When we know what kills men in coal mines, why don't we stop the cause? It can be done!"

Statistics show the fatality rate in small truck mines is ten times greater than in the large commercial mines. This condition is due entirely to the laxity of supervision in the small truck mine. The fatality rate climbs or decreases in direct proportion to the amount of sincere and intelligent accident preventing supervision that is applied to this great problem.

Speeding Up Haulage

Present day conditions in coal mining call for speeding up of general mine haulage. This in itself creates addi-

tional hazards. Demand for cars of greater capacity has resulted in newer designs that have three inches and less of clearance over the mine tracks. Many of the newer types of mine cars have omitted brakes entirely. Control of these high speed trips on steep grades has thrown dependance for safety more and more on perfecting the mine track itself and upon the application of external safety devices to assist the motor crews in the control of their trips.

The most adequate mine lighting system that can be procured is an essential to safe coal mining. With motor crews operating at high speeds in high velocities of air, their need for maximum light volume from a steady dependable source is paramount. Safety follows light. Electric mine lamps, now available through the granting of the latest approvals by the United States Bureau of Mines, furnish 50 percent greater light volume than has hitherto been possible and yet the newest developments in these lamps actually weigh less than the majority of lamps now in service. The use of open flame lamps on haulage crews, subject as they are to blowing out at crucial moments by extreme volumes of air, should be done away with and

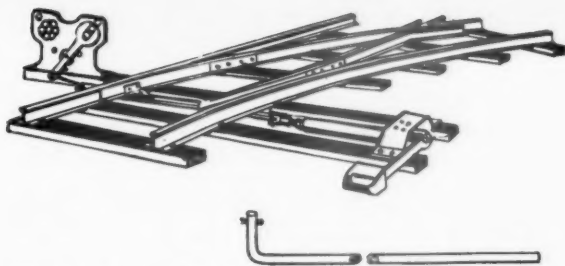
replaced by the far greater dependable brilliance of the modern electric mine lamp.

Great study has been applied to the causes of haulage accidents and time tested devices have been developed to assist in this problem of control. These devices fall into two general classes; devices that have to do with perfection of track and the advance indication of condition of switch points, and those that govern standing or moving trips.

Perfecting Track Conditions

In the former classification great strides have been made in joints of track where transitions occur from one size rail to another. Great care has been taken in the design of such devices, combining safety thru great strength with practicability in eliminating "rights" and "lefts". The transition rail is an easily handled short section, 26 in. in length, conforming exactly to one size rail at one end and to a different size rail at the other. These rails are made in practically all combinations of sizes. They are quickly attached with standard fish plates or angle bars which reinforce them and are suitable for all reductions of 20 lb. or more.

Compromise rail splicers have been developed for 10 lb. transitions having a small mid-section that is a miniature transition rail with fish plates or angle bars cast thereto as an integral part. They are quickly installed by merely bolting to the rail ends to be joined.



Switch signal using efficient reflector buttons gives advance notice of switch condition

Like the transition rail, the use of "rights" and "lefts" is eliminated and an absolutely smooth joint of great strength results.

Condition of Switch Points

Many haulage accidents have resulted from not knowing in advance the condition of switch points being approached. To correct this situation a safe and dependable switch signal has been developed using the most efficient type of reflector buttons. Headlights of oncoming motors will pick this signal up 1,000 ft. away, and it can be seen for hundreds of feet by the reflection of a motorman's electric cap lamp. This device is mounted on the tie and attached to the end of the bridle bar on the side opposite the switch throw. It is the only device of its kind that not only indicates the exact position of the switch points at all times, but also whether the switch turns off to the right or left of the main line. Once installed it requires no maintenance. The device carries

adjustments which permit its use on all sizes of switches.

For controlling moving trips on steep grades, running skids are available in easily handled single wheel



Such items as mine car stops are contributing to greater safety in haulage

lengths. These skids have renewable half-soles of special alloy metal which combine maximum braking power with maximum wear. They are very effi-

cient on main lines and for use at loading points in conveyor mining.

Safeguarding Standing Trips

For blocking and safeguarding standing trips or cars, easily handled holding skids can be used to block wheels in either direction. Under impact this device gives, takes up shock and stops car or trip by friction brake action. It cannot be dislodged accidentally once the car wheel is upon it.

Mine car stops are obtainable having a great factor of safety, as they combine both the impedance and the derailer principles. These stops are quickly and easily attached to the rail without the use of bolts and nuts, and can be swung into the "on" or "off" position. Under terrific impact the car stop head tilts outward throwing the runaway off the tracks, thus derailing automatically what it cannot stop and hold.

For derailment of runaway trips or cars a safe practical device has been designed which will derail from either direction. The derail head is hinged to the base and can be thrown on and off as quickly and easily as throwing a switch. The base can be attached to the rail at any point by merely bolting it to the base of the rail.

Haulage accidents can be prevented. Not only from the humanitarian standpoint but because of the tremendous yearly cost of these accidents in lives, injury to personnel and to equipment, safety devices, when available, must be adopted to remove the causes and to mitigate all such accidents.

NIAA Plans For 1939 Conference

The annual conference of the National Industrial Advertisers Association will be held in New York, September 20, 21 and 22, at the Hotel New Yorker under the sponsorship of the association's New York Chapter, the Technical Publicity Association. The New Jersey Chapter, Industrial Marketers of New Jersey, will be co-hosts.

Edward Phoenix, Johns-Manville Co., president of the New York Chapter, is chairman of the General Conference Committee. Members of this Committee are: R. Barbour, Bakelite Corporation; K. Lydiard, Fred Glen Small; C. Neighbors, Babcock and Wilcox Company; R. Wensley, G. M. Basford Company; R. Davison, New Jersey Zinc Company; C. McDonough, Combustion Engineering Company, Inc.; K. Bailey, Thomas A. Edison, Inc.; and W. Cather, Babcock and Wilcox Company.

The Program Committee, under the chairmanship of Roger Wensley, president of the G. M. Basford Company, has already formulated its plans. Several sessions will be devoted to clinic meetings which have proved so popular at the association's conference of recent years.

Mines Reopened By Park Utah Consolidated

Late in May the Park Utah Consolidated Mines Company resumed operations at its Park City property, which had been shut down since May of 1938. Employees numbering about 150 are now back at work—about one-third of the number on the company's payroll at the time operations were shut down in 1938.

O. N. Friendly, vice president and general manager, reported that the

company's decision to reopen its property was made on the basis of reports from Washington that Congress was likely to extend the domestic silver purchase program, in which case its operations would be speeded up to normal capacity with the re-employment of more men.

At the annual meeting of stockholders of the company, Mrs. Catherine H. Luedeking, of Cincinnati, Ohio, was elected to the board of directors to succeed Otto Luedeking, deceased.

Directors of the Golden Cycle Corporation recently voted unanimously to start work on a new drainage tunnel in the Cripple Creek district. The new tunnel will be approximately 1,000 ft. below the President Roosevelt tunnel, and will prolong the life of the mining camp more than 10 years. Work was expected to start on the project about May 1, and total cost was estimated at about \$1,000,000.



JAMES W. WADE
General Chairman

PROGRAM and ARRANGEMENTS TAKE SHAPE for SALT LAKE MEETING

● *6th Annual Metal Mining Convention and Exposition of the American Mining Congress to Crystallize Thought on Industry's Problems*

Arrangements Committee Chairmen



OSCAR N. FRIENDLY
Entertainment



WM. J. O'CONNOR
Reception



J. O. ELTON
Trips



GLOYD M. WILES
Hotels



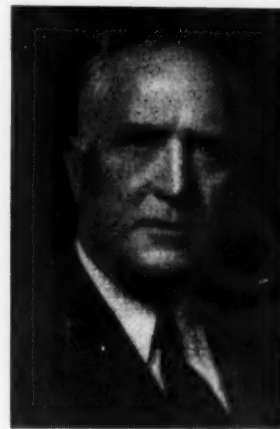
G. W. SNYDER
Publicity

Convention and Exposition activities will center at the Minerals Building in the State Fair Grounds. In charge of special arrangement features are the men pictured at the left—Oscar N. Friendly, Entertainment; W. J. O'Connor, Reception; J. O. Elton, Trips; Gloyd M. Wiles, Hotels; and Geo. W. Snyder, Publicity.

The Convention program will crystallize the best thought available on economic, legislative, fiscal, labor and operating problems—subjects foremost in the minds of mine operators and executives as they plan for the future. Preliminary listing of the program subjects is shown on the opposite page. Speakers are being invited as we go to press—you can count on an array of unsurpassable talent.

MEET and mingle with the salt of the metal mining industry in Salt Lake City, August 28-31 at the sixth Annual Metal Mining Convention and Exposition of the American Mining Congress, Western Division. Treat yourself to the many fine educational and pleasure-assuring features being arranged by enthusiastic mining men under the leadership of George Rupp, national chairman of

the Program Committee, and James W. Wade, general chairman of the Arrangements Committee. D. D. Moffat, chairman of the Board of Governors of the Western Division, is cooperating closely in developing the many plans under way, as are James Ivers and A. G. Mackenzie, governor and secretary, respectively, of the Utah Chapter of the American Mining Congress.



D. D. MOFFAT, Chairman
Western Division

Preliminary Program

MONDAY, AUGUST 28

FIRST SESSION—MINERALS AND NATIONAL DEFENSE

The Strategic Minerals Program
Developing Domestic Sources of Deficient Minerals
Mineral Resources and World Politics

SECOND SESSION—PROSPECTS FOR THE METALS

Brief Resumés of Current Status and Outlook for Copper, Lead, Zinc, Iron Ore, Gold, and Other Metals and Minerals
The Future of Silver

TUESDAY, AUGUST 29

THIRD SESSION—OPERATING PROGRESS

New Equipment and Improved Practices in Metal Mining
The Morenci Pit
Progress in Milling Practice and Equipment
Contract Systems in Metal Mining

FOURTH SESSION—LABOR PROBLEMS

Industrial Relations
The Wagner Act and the Mining Industry

WEDNESDAY, AUGUST 30

FIFTH SESSION—HEALTH PROBLEMS IN MINING

Air Hygiene in the Mining Industry

Be on hand to listen in on the above program, arranged for your education and enjoyment by the Program Committee headed by George Rupp (right) as national chairman. Below—a crowded session at the Los Angeles Convention in 1938.

A Critical Review of Occupational Disease Legislation

SIXTH SESSION — MONETARY LEGISLATION—
MINE FINANCING

Monetary Legislation
Problems of Mine Financing
The Needs of Primary Mining Ventures

THURSDAY, AUGUST 31

SEVENTH SESSION—TAXATION

The 1939 Revenue Act and Western Mining
Trend of Federal Taxation
Economic Effect of Present Taxes on the Mining Industry

EIGHTH SESSION—TARIFF—WAGE HOUR ACT
Experience Under the Foreign Trade Agreements

Application of the Wage-Hour Act to Mining



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A full program of trips will be headed by one to the world famous Bingham pit of Utah Copper Co.

Entertainment plans include a Welcoming Luncheon Monday noon; a Buffet Dinner with dancing and entertainment Monday night on the beautiful terrace of Salt Lake Country Club; a Jamboree at Saltair Pavilion Wednesday night, with swimming in Great Salt Lake, a fine picnic dinner, special refreshments, dancing, a floor show and the thrills of roller coasters, etc., if you like this form of sport; and the Annual Banquet Thursday night, with addresses by nationally known leaders, special entertainment of high caliber, and dancing. Featured as guest artist at the Banquet will be Alec Templeton, the blind musical genius who has been thrilling American concert and radio audiences with his versatility at the piano, including classical renditions and novel and intricate improvisations without end. His happy smile and puckish sense of humor add to



JAMES IVERS
Toastmaster, Annual Banquet

his remarkable talent in delighting his listeners. Plans are contemplated for transforming the lobby of Hotel Utah into a beautiful and spacious banquet room, with ample room to accommodate the large crowd so that all may see and enjoy the entertainment.

Heading a subcommittee in charge of the Banquet is James Ivers, who will also serve as toastmaster. The plans for the Country Club party are being supervised by M. D. Paine, and those for the Saltair Jamboree by C. T. Keigley.

Arrangements for Friday and Saturday following the convention proper are still pending. It is anticipated, however, that Governor Carville of Nevada will call a further session on Friday of the "Governors' Silver Conference," organized in Reno, Nev., March 27, 1939, to be held in the Utah State Capitol, which would be open to all interested mining men.

Trips to famed mining and metallurgical operations in and near the Salt Lake Valley are being arranged for Saturday; and if the Silver Conference plans don't materialize, additional tours will be made on Friday.

Special entertainment is likewise being developed for the ever-increasing number of ladies attending these meetings. A variety of functions will assure pleasant hours during the daytime, details of which will be announced later.

Arrangements for the biggest and best Exposition ever offered metal mining men are now virtually complete. The arena of the Minerals Building will be literally packed with a great variety of metal mine equip-

Don't miss the fun Wednesday night at the Saltair Jamboree. Equally pleasant entertainment is in store on Monday night on the terrace of Salt Lake Country Club and at the Banquet on Thursday





At least one corking good cost-cutting idea may be found in each exhibit at the Exposition

ment and supply items needed in present day efficient operations. There'll be at least one new and worth-while cost-cutting idea in each booth, and manufacturers' experts will be there to explain how it'll work. The Exposition will be open until 6 p. m. each day of the Convention, and through special arrangement will be held open Tuesday until 10 p. m. for the convenience of those wishing further time to see the exhibits.

Being the only national display of its kind in the metal mining field—intimately tied in both in location and in purpose with the Convention proper—both operators and manufacturers have been loud in its praises. The rewards are of mutual and lasting benefit.

A partial list of companies who will exhibit their latest products includes:

Allen-Sherman-Hoff Co.
Alloy Steel & Metals Co.
American Steel & Wire Co.
Anaconda Wire & Cable Co.
Atlas Powder Co.
Bethlehem Steel Co., Inc.
Bucyrus-Erie Co.
Bullard Co., E. D.
Card Iron Works Co., The C. S.
Carnegie-Illinois Steel Corp.
Colorado Fuel & Iron Corp., The
Columbia Steel Co.
Denver Fire Clay Co., The
Du Pont de Nemours & Co., Inc.,
E. I.
Edison, Inc., Thomas A.
Eimco Corporation.
Electric Storage Battery Co., The.
Engineering & Mining Journal.
General Electric Co.

Goodman Manufacturing Co.
Hercules Powder Co.
Jeffrey Manufacturing Co., The.
Kansas City Structural Steel Co.
Kennedy Van Saun Mfg. & Engrg. Co.
Link-Belt Company.
Mancha Storage Battery Locomotive Co.
Marion Steam Shovel Co.
Mine Safety Appliances Co.
Mining Congress Journal.
National Tube Co.
Nordberg Manufacturing Co.
Ohio Brass Co.
Pomona Pump Co.
Roebbling's Sons Co., John A.
St. Louis Power Shovel Co.
Salt Lake Hardware Co., The.
Sauerman Bros., Inc.
Standard Oil Company of California.
Sullivan Machinery Co.
Talcott, Inc., W. O. and M. W.
Texas Company, The.
Timken Roller Bearing Co., The.
Tool Steel Gear & Pinion Co.

Traylor Engrg. & Mfg. Co.
United States Steel Corp. Subsidiaries.
Utah Power & Light Co.
Victaulic Company of America.
Western Cartridge Co.
Western Colorado Power Co.
Western Precipitation Corp.
Westinghouse Elec. & Mfg. Co.

The "air-conditioned" ozone of the wide open spaces will be ideal at this time for a vacation outing. Utah is in the heart of National Park country, with any number only an overnight trip. And then there's the world famed San Francisco Golden Gate Exposition on Treasure Island which can be visited conveniently either going to or returning from the Convention.

Mark the dates on your calendar NOW—August 28, 29, 30 and 31—and plan to spend them in Salt Lake City.

Great White Throne
in Zion National
Park



With the COAL DIVISION

of the AMERICAN MINING CONGRESS

FACTORS AFFECTING COAL SCREENING

THE most successful solution of any coal screening problem is possible only by having available complete data pertaining to that particular coal.

That anyone having a screening problem to solve may obtain and provide essential information, the data sheet on the following page has been suggested, and the more completely the questions therein are answered, the more intelligently and completely the problem can be solved.

A—Markets Available

This is given first consideration for the reason that it quite definitely fixes the need, if any, of screening and the sizes that must be made to satisfy the available market. The experienced screening engineer is familiar with the requirements peculiar to each industry, and such information will be very helpful in his selection of suitable equipment.

B—Competitive Fuels

If gas is available it should be stated whether it is natural, manufactured, coke oven or a combination of two or more. The price charged would be of utmost importance.

All possible data pertaining to oil competition should be included, and the same is true of coke, wood, imported coal and any other fuel that must be competed with.

C—Shipping Conditions

This may seem to have little to do with screening but must be carefully studied. Probably the most important item is the difficulty resulting from frozen coal in railroad cars but there

are many other items having their affect upon the screening problem as a whole.

D—Other Competitive Conditions

Complete information on each of the items listed is of utmost importance.

A competitive high grade coal requiring no cleaning or special preparation may be a difficult obstacle if available in quantity.

Limited sizing always makes the road easier, and extensive sizing usually requires extremely careful study that screen equipment is selected which is fully capable of preparing the coal efficiently and economically.

Screen preparation of coal for wet and dry coal cleaning purposes requires separate and distinct technique and many items enter into such screening problems. For example, the selection of screen cloth may have important bearing such as square mesh, elongated opening short and long or special weaves or wire composition which only experience has proved essential for certain conditions.

In the past few years dedusting of coal has become of prime importance and is full of pit falls for the inexperienced. To know at what mesh to dedust requires knowledge not alone of the coal but also the market requirements. Different types of stokers require different dedusting treatment and dedusting may be necessary for various reasons such as elimination of clinker, increased ash fusibility temperatures, removal of high ash or sulphur carried in the dust sizes and many other similar conditions.

Dedusting (by screening) must not be confused with dust allaying, which is a subject requiring entirely independent study.

The drying of coal is a deep problem and is closely allied to dewatering. Many drying methods are employed, the earliest of which might better be classed as drainage. Perforated bot-

tom conveyors were an early type as were large drawing storage bins which experience the difficulty of size segregation, a serious objection in the by-product coke industry.

Heat drying of coal is successfully resorted to usually for the fine sizes only. Many types of heat driers are employed, but extreme care must be used that the cost, both operating and maintenance, is not excessive.

The continuous feed and discharge centrifugal coal drier is extensively used and to good advantage where wet washing is done, but usually requires dewatering equipment for the solids thrown off with the water and in some instances filters are needed.

Dewatering is another problem requiring expert consideration. It may be done ahead of both centrifugal and heat drying of coal or it may be quite successfully done independently of both.

Wedge wire dewatering screens are used under drainage conveyors, drainage bins and on high speed vibrating screens. That all wedge wire has been manufactured in either England or Germany is objectionable on account of both the cost and possible delay in delivery of the desired specifications.

Considerable substitution of wedge wire is occurring using stainless steel woven wire cloth and in many instances with improved results both from a cost and dewatering efficiency basis.

E—Mine Operation Data

A little study of this section of the questionnaire will show the importance of this data. Common deficiencies in data presented with requests for screen recommendation are:

(a) Tonnage per day stated, but hours per shift and number of shifts not given.

(b) Tonnage of coal per hour stated, but no data as to whether this is an average over entire day or a peak load condition. Usually there are peak hours during which the tonnage may be almost double the average figure.

NOTE: This report by G. R. Delamater, who is a member of the Coal Division Committee on Surface Preparation, is submitted in tentative form to the members of the Committee and may be subject to some revision and correction before final adoption.

SCREEN DATA SHEET

For Preliminary Investigation of a Screening Installation

A—Markets Available—(See Section G for Details)

- (1) Industrial steam { Mine run.
Prepared sizes.
Powdered fuel.
- (2) Domestic.
- (3) By-product coke.
- (4) Bee-hive coke.
- (5) Railroad.

B—Competitive Fuels

- (1) What sizes to compete with.
- (2) Oil.
- (3) Gas.
- (4) Coke—coal or petroleum.
- (5) Wood.
- (6) Imported coal.

C—Shipping Conditions

- (1) Railroad.
- (2) Truck.
- (3) Freezing temperatures—sizes affected.
- (4) No freezing temperatures.
- (5) Fair freight rates } Give details of markets
- (6) Prohibitive freight rates } affected.

D—Competitive Position of This Mine

- (1) High grade coal requiring no cleaning.
- (2) Limited sizing (give details).
- (3) Extensive sizing (give details).
- (4) Wet cleaning (give details).
- (5) Dry cleaning (give details).
- (6) Combined wet and dry cleaning (give details).
- (7) Dedusting by screens or air or both.
- (8) Dust allaying by oil, salts, etc.
- (9) Heat drying.
- (10) Centrifugal dryers.
- (11) Dewatering.

E—Mine Operation Data

- (1) Number of shifts per day { a. Mine.
b. Preparation plant.
- (2) Hours per shift.
- (3) Tons per shift.
- (4) Tons per hour. (Include complete data on peak loads if such exist, giving maximum rate of feed for short intervals.)
- (5) Hand loaded coal—percent as per size consist.
- (6) Machine loaded coal—percent as per size consist.
- (7) Pillar coal.
- (8) Number of operating days per week.
- (9) Maximum number of consecutive idle days which are probable, having effect on moisture content of coal.
- (10) Long or short outside haul, also affecting moisture content of coal.
- (11) Power specifications.

F—Existing Screen Equipment Data

- (1) Make of screen.
- (2) Type.
- (3) Size.
- (4) Number of strokes per minute.
- (5) Length of stroke.

	Round Dia.	Clear Square	Rectangular	Other Shape	Punched Plate or Woven Wire?
(6) Decks:					
Top			X		
Middle			X		
Bottom			X		

- (7) Feed, tons per hr. Average Maximum

(8) Deck products:

	Tons per hr.	Oversize	Undersize
Top%%%
Middle%%%
Bottom%%%

(9) Percent free moisture in feed coal

{ Max. percent.
Min. percent.
Max. length of
time the max.
moisture may
last.

- (10) Screen analysis of feed.
- (11) Describe how free moisture was determined.
- (12) Screen cloth or plate life:
- (a) Operating hours.
- (b) Tons of coal handled.
- (13) Horsepower required.
- (14) Operating and maintenance cost per ton.
- (15) Any other operation data of interest.
- (16) Screen inclination.

G—Coal Sizes Marketed

	Round hole	Square hole
(1) Lump coal, retained on	.....	.....
(2) Egg coal, " "	.....	.....
(3) No. 1 Nut, " "	.....	.....
(4) No. 2 Nut, " "	.....	.....
(5) Pea coal, " "	.....	.....
(6) Slack coal, through	.....	.....
(Give details of any other shape of openings used.)		
(7) Stoker coal {	Commercial	.....
	Domestic	.....

H—Special Mixtures

Information should be included here on all special mixtures and crushing of the larger sizes, etc.

J—How to Be Marketed

Independent selling or selling through general agencies.

K—Market Prices

Differentials of sizes.
Percentages of oversize and undersize permissible without detrimental effect on sales realization.

L—General Characteristics

- (1) Name of coal seam.
- (2) Anthracite..... Bituminous..... Lignite.....
- (3) Geographical location.
- (4) Deep mine—approximate cover.
- (5) Strip mine.
- (6) Coal hardness { Hard.
Medium hard.
Soft.
- (7) Fracture.
- (8) Dirt in large sizes.
- (9) " " intermediate sizes.
- (10) " " fine sizes.
- (11) Fusion temperature of ash.
- (12) Is screen to go into new or existing building?
- (13) What limitations as to space available?

M—Screen Analyses

	Retained on	Through	Percent
(1) Lump,
(2) Egg,
(3) No. 1 Nut,
(4) No. 2 Nut,
(5) Pea coal,
(6) Slack coal,

- (7) Any and all additional screen analyses available.

With the COAL DIVISION

(c) While the "number of operating days per week" may appear to be of no importance to the screen manufacturer, it does frequently mean much to him. Even a dry mine requires the handling of some water, and working places going temporarily to the dip frequently make water which, being a temporary condition, is removed by soaking it up in the machine cuttings. The wetness of the slack coal is thus greatly increased by the consecutive-ness of idle days.

Long outside hauls also result in high moisture of coal in wet weather, and to make fine mesh screening possible at all, the practice of storing coal in pit cars for several hours outside of the mine may have to be abandoned.

F—Existing Screen Equipment

If screen equipment of any type is already in use, complete data regarding same should be recorded and any difficulties such as blinding, low capacity or screening efficiency, etc., should be stated, as such information may bring out the need of unusual care in the study of the problem and the selection of suitable screen equipment.

Ordinarily the blinding of fine mesh cloth by wet fine sizes results in the formation of a coating over the surface of the cloth rather than blinding between the wires. Occasionally, however, certain materials may be present in the coal which build up gradually entirely around each wire, resulting in a slowly increasing diameter of the wire and a decrease in the opening between them, affecting the fineness of separation accomplished and eventual total blinding of the screen.

Such conditions can only be overcome by resorting to special weaves of cloth, the use of stainless steel cloth, the application of heated air or perhaps a combination of part or all of these.

Above all, remember that each and every coal has its own peculiar characteristics, and frequently must be handled a little differently than even other coal from the same district.

G—Coal Sizes Marketed

Too often the screen manufacturer is asked to recommend and quote upon screens with little or no data presented to show the screen analysis of the feed coal. If some separation sizes are given, the writer may neglect to state whether square or round hole is intended or it may be merely stated as a lump coal, egg coal, nut coal or pea whereas no set standards have been adopted for such coals in various districts or sometimes even in mines in the same district.

The need is therefore readily apparent for giving exact data pertaining to these items.

H, J & K

These are all items of which the completeness of the answers will affect the reliability of the screen equipment recommendations made.

L—General Characteristics

It is not uncommon for a screen manufacturer to receive an inquiry asking for quotation on screen equipment to handle a given tonnage and to make specified separations but with no data given other than that. In addition, a guarantee is required on the performance of the screen, yet the purchaser is unable to guarantee the characteristics of the coal to be screened. The unfairness of this is quite evident.

The name of the coal seam and its geographical location is always helpful. The difference will be readily understood between a strip mine and a shaft mine when considering the screening of the coal, and the hardness and fracture are also of utmost importance.

Coals differ greatly as to the location of slate, bone and other undesirable ingredients; and it should be definitely determined as to just what sizes carry any free impurities, as frequently the general product can be greatly improved in quality by eliminating a size of very high ash content by screening.

It has even been found that in some coals normally of good coking characteristics, certain sizes are absolutely non-coking, and their removal greatly improves the coke quality.

Ash fusion temperature has become of great importance, and it has been found that this varies greatly in the various coal sizes. An instance of this is a West Virginia coal in which the fusion point in the coal through 20 mesh was much lower than that of the coal retained on 20 mesh. It was found that even the removal of but half of the minus 20 mesh dust resulted so beneficially that it was profitable to provide screens for this purpose.

When first undertaken, the removal of but 50 percent of the minus 20 mesh dust by screening was all that could be accomplished, but further improvement of the screens employed has resulted in the removal of 75 percent of this minus 20 mesh dust.

M—Screen Analyses

Screen analyses are therefore of utmost importance, and it is always an advantage to make these screen tests as complete as possible.

For example, assume a 1 1/4-in. by 0-in. slack coal to be screened making a 1/2-in. separation. While it is important to know the percentage over and through the 1/2-in. screen, it is equally important to know the percentage of coal that would pass through a 1/4-in. screen, this directly affecting screen capacity.

In explanation of this, it would be possible to have two 1 1/4-in. by 0-in. slack coals analyzing approximately as follows:

	Sample A	Sample B
1 1/4" x 1/2"	50.0%	50.0%
1/2" x 1/4"	40.0%	20.0%
1/4" x 0"	10.0%	30.0%

The 1/2-in. by 1/4-in. coal is what is commonly called a "near mesh" coal or a size close to the point of separation. As the percentage of near mesh coal increased the screen separation becomes more difficult and the capacity of the screen is reduced; for this and other similar reasons it will be seen that complete screen analyses are very essential.

To sum up the primarily essential items around which all the other data is classified, the following is listed as information absolutely necessary on every coal screening problem.

- (a) Surface moisture content of coal.
- (b) Screen analysis.
- (c) Screen efficiency required.
- (d) Screen inclination necessary.

Determination of surface moisture content is a bone of contention at the present time, but for all commercial purposes so far as screening is concerned, the loss in weight by air drying, preferably over a steam coil, is satisfactory. Drying over a gas flame or more or less direct application of heat should be avoided as liable to burn away some of the volatiles.

Screen efficiency as commonly expressed is the percentage of coal retained on a screen having the opening of desired separation, i.e., assume a separation at 1/2-in. and the product over the screen containing 8 percent coal that will pass through a 1/2-in. test sieve, the efficiency is 92 percent.

Usually a 92 percent efficiency is considered good practice providing not to exceed 2 percent is fine dust under-size.

Extremely high screening efficiency can only be obtained at increasingly mounting cost, and an efficiency no higher than market conditions demand will increase the screening profits.

Submitted May, 1939,

By GEO. R. DELAMATER.



WHEELS of Government

● *As Viewed by A. W. Dickinson of
the American Mining Congress*

WITH the disposal of the Revenue bill, the relief bill and the monetary bill late in June and early in July, Administration leaders are taking stock of the legislative situation with a view to deciding whether to adjourn Congress by the middle of July or to carry on through the summer. The neutrality matter, railroad relief legislation and the "self-liquidating" spending program are the chief remaining issues. The latter two are not popular with the members of Congress and the question of neutrality legislation may be very quickly settled by the Senate, the House leaders and the President.

A decided highlight in the activities of the Congress, particularly in the Senate, was the handling of the monetary bill which finally became law when approved by the President on June 6. This is the bill which was originally intended to extend the powers of the President over the \$2,000,000,000 stabilization fund, the devaluation of the dollar, and the right to fix by proclamation the coinage rate for domestic mined silver. As the bill passed the House some weeks ago it contained only these features and no more. Reported in similar form by the Senate Committee on Banking and Currency the bill met with a spirited attack on the Senate floor from anti-devaluation Democrats and Republicans led by Senator Carter Glass of Virginia. Immediately the silver Senators, who had waited long for the opportunity, amended the bill to provide a statutory rate for the coinage of newly mined domestic silver at a net return of 77.57 cents per ounce to the producer. Other amendments struck out the devaluation power of the President and also the power of the Treasury to purchase foreign silver. In the hands of the Senate and House conferees the bill

was changed to the extent of restoring the devaluation powers and the purchase of foreign silver, while the coinage seigniorage on domestic silver was set at 45 percent of the monetary value of \$1.29292 per ounce, thus giving the producer a price of 71.11 cents per ounce. The House quickly approved the report of the conferees, but in the Senate a filibuster carried on past midnight June 30, which was the expiration date for stabilization fund and dollar devaluation powers as well as for purchase of newly mined domestic silver. However, the Attorney General advised that the expiring law could be renewed at any time, and the Senate agreed to vote on the measure at 5 p. m., July 5. It is of interest to note that the Treasury had threatened to apply the 50 percent silver transfer tax to the 77.57 cents price which the Senate had granted for domestic silver, assessing such tax on the difference between that figure and the world price, but that in the conference such silver was specifically exempted from the application of this tax. On Wednesday, July 5, after long and bitter debate the conference report was adopted by vote of 43 to 39, due in the main to the farsightedness and statesmanlike handling of the situation by Senator Key Pittman of Nevada.

Taxation

Time records were broken in June in the quick handling of the Revenue bill of 1939. The House and Senate both passed the bill, the conferees reported, and the two houses approved the report all in one week. The bill, which is now law, removes the undistributed corporate earnings tax and substitutes a flat 18 percent corporation income tax for corporations earning in excess of \$25,000, with rates

of 12½ to 16½ percent for corporations with net incomes below that figure. Also included were authority to carry over net losses for a two-year period; permission for corporations to increase capital stock valuation for years ending June 30, 1939, and June 30, 1940; elimination of the present \$2,000 limitation in the deduction of capital losses; and a Senate amendment which provides an optional method of computing inventories to permit the use of the "last-in, first-out" method. There were other helpful features in the bill, and the entire measure follows very closely the recommendations on Federal taxation contained in the Declaration of Policy approved by the Los Angeles Convention and by the annual meeting of the American Mining Congress and repeatedly urged in hearings before the Ways and Means and Finance Committees.

It has just been announced by Chairman Doughton of the House Ways and Means Committee following a conference of Congressional leaders with the President and Secretary Morgenthau, that a comprehensive study of the Federal tax laws will be made this fall by the Ways and Means Tax Subcommittee under the Chairmanship of Representative Jere Cooper of Tennessee. Previously there had been proposals that the study be conducted by the Joint Committee on Internal Revenue Taxation made up of five Finance Committee Senators and five Ways and Means Committee Representatives, but it is reported that Chairman Pat Harrison of the Senate Finance Committee felt that as revenue legislation must originate in the House the study should be made under the Committee on Ways and Means. The work of the Subcommittee under Chairman Cooper will be carried on in executive session

in which assistance will be given by the Treasury Department and by the staff of the Joint Committee on Internal Revenue Taxation.

National Labor Relations Act

Following the appearances made by mining witnesses before the Senate Committee on Education and Labor last month, the hearings have continued and are still going on. Further industrial witnesses have appeared before both the Senate and House Committees, but the time of the latter, as in the past, has chiefly been taken up by witnesses from the National Labor Relations Board and from various labor organizations. The chance for corrective amendment to the Act in the present session of Congress now seems remote.

In the meantime the National Labor Relations Board has announced proposed changes in its regulations which will permit an employer to petition the Board for investigation and certification of a labor union in its plant. Certain other minor changes of the regulations are in contemplation. Concurrently the House of Representatives is engaged in passing a resolution calling for an investigation of the National Labor Relations Board which will undoubtedly take place this summer and fall unless the Labor Committees of Congress decide to immediately become more receptive to necessary amendments to the law.

During the past month the Sixth Circuit Court of Appeals at Cincinnati ruled against the National Labor Relations Board and severely criticized its procedure in requiring that the ballot in an election among 3,000 employees of the Consumers Power Company of Jackson, Mich., offer only a choice of voting for a CIO union or no union at all.

Wage-Hour

The amendments to the Fair Labor Standards Act have remained on the House calendar since June 5 when Chairman Mary Norton again failed in her attempt to secure consideration under a suspension of the rules. She announced at that time that she was through.

A published interpretation by the Wage-Hour Administration to the effect that time spent by employees in attending safety meetings and lectures is to be paid for by the employer, was the subject of a conference in the Wage-Hour Division offices on June 15. American Mining

Congress representatives protested that the interpretation would break down the important mine safety programs throughout the country. Administrator Andrews responded on June 16 with the following announcement:

"You will note that paragraph 15 (of Interpretative Bulletin No. 13) contained two tests: (1) whether attendance is voluntary and (2) whether the meeting or lecture is directly 'related to the employees' work.' In our opinion safety meetings which take place after working hours and are conducted as a part of a general safety program which is sponsored or approved by a Government agency or by any recognized independent organization engaged primarily in disseminating safety information, will not ordinarily be directly 'related to the employees' work' and, if attendance is voluntary, will not be considered as 'hours worked.' Different considerations, as indicated in the Interpretative Bulletin, apply to mine rescue. The foregoing opinion, although not binding upon the Courts, will guide the Administrator in carrying out his enforcement duties under the Act."

In the near future another conference will be held with the Wage-Hour Administration for the purpose of still further clarifying the above interpretation.

Federal Inspection of Mines

The Neely bill (S. 2420), which directs the Secretary of Interior to make annual inspections of coal mines and to make additional inspections upon the request of miners or their representatives, was the subject of further hearings on June 13 and June 20 before the Senate Mines and Mining Subcommittee. At both hearings the American Mining Congress presented witnesses in opposition to the measure, who placed full information at the disposal of Senator Logan's Subcommittee. Those appearing were: A. W. Dickinson, American Mining Congress; Herbert S. Salmon, vice president, Alabama Mining Institute; Ezra Van Horn, vice president, Ohio Coal Association; John Ira Thomas, Secretary of Mines for the Commonwealth of Pennsylvania; N. P. Rhinehart, Chief, Department of Mines of West Virginia; Norman S. Patton for the anthracite industry; also appearing were J. D. Battle, National Coal Association; J. V. Sullivan, West Virginia Coal Association; and B. H. Canon, Pennsylvania Coal Associations. In concluding the hearing Chairman Logan set July 1 as the final

date for the filing of additional statements and briefs. The bill has not as yet been considered by the Mines and Mining Subcommittee, and it is believed that sentiment in the full Mines and Mining Committee is against the passage of such a measure. It is essential, however, that all coal and metal producers express their opposition to the Neely bill to their Congressional delegations.

Bituminous Coal Division

Effective July 1 the administration of the National Bituminous Coal Act (Guffey Act) was placed under the newly created Bituminous Coal Division in the Department of the Interior. Howard A. Gray, originally an architect from Chicago and more recently head of the PWA under Secretary Ickes, is in charge of the Division, and his administrative assistant is Dan Wheeler who has been in the Federal service for many years. Former Coal Commission Chairman Percy Tetlow will act in advisory capacity, as will a number of others of the old Commission's staff. It is reported that the Bituminous Coal Division will proceed toward the promulgation of prices in their attempt to administer the law. In the meantime there are reports of a bill providing for restriction of coal production and allocation of output which may be introduced in the near future. It is not known that Secretary Ickes or his General Solicitor, Nathan Margold, are interested in this proposed bill at the present time, but Ickes' connection with the conduct of the petroleum industry in NRA days would indicate that he may favor a similar type of handling for the difficulties of the coal industry.

Stream Pollution

The Mansfield Stream Pollution bill is slated for a House vote under a rule during the week of July 10, and while passage of the bill in its present form, which is acceptable to mining, oil and other industries, is anticipated, there may be a heavy vote against the measure stimulated by members of wildlife, fishing and other outdoor associations. Representative Mundt of South Dakota will probably endeavor to substitute his mandatory pollution prevention bill for the Mansfield bill, but it is believed that Judge Mansfield, Chairman of the House Committee on Rivers and Harbors, will be successful in securing the passage of his measure.

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GENERAL ELECTRIC

008-46



NEWS and VIEWS

Ireland Heads Ohio Coal Association

At the annual meeting of the Ohio Coal Association, held June 7 at the Hotel Cleveland, Cleveland, Ohio, the following officers were elected for the coming year: R. L. Ireland, Jr., president; E. H. Davis, vice president; R. L. Ireland, Jr., chairman of the board; Ezra Van Horn, executive vice president; D. F. Hurd, secretary and treasurer; and E. H. Miller, assistant secretary and assistant treasurer.

The following directors of the association were also elected: W. P. Cayton, S. A. Cottingham, E. H. Davis, R. L. Ireland, Jr., S. B. Johnson, Geo. M. Jones, Jr., J. H. Miles, J. C. Nelms, W. L. Robison, R. W. Rutledge, H. G. Schmidt, G. K. Smith, Whitney Warner, and E. S. Willard.

Flotation of Silver Ores

That the flotation process may supplant or supplement smelting and cyanidation as a method for treatment of many silver ores is indicated by experiments conducted by the Bureau of Mines, U. S. Department of the Interior.

All the commercial silver minerals can be floated successfully under proper conditions, it is shown in a report just published by the Bureau. These conditions are discussed in some detail and the adverse action of slime and certain reagents are pointed out.

The concentrates from flotation must be treated at the mine or sent to a smelter. During 1937, 95 percent of the silver recovered in the United States resulted from the smelting of rich ores and concentrates, and only 4 percent from the cyaniding of ores and concentrates.

This report is the latest addition to the Progress Reports series of the Metallurgical Division of the Bureau of Mines, and is designated as Report of Investigations 3436, "Some Factors Affecting the Flotation of Silver Minerals," by E. S. Leaver and J. A. Woolf. Copies may be obtained from the Bureau of Mines, Washington, D. C.

Holmes Safety Awards

Heroes of industry, whose courage and resourcefulness were manifested in time of emergency in the work of producing the nation's essential minerals, were recognized by the bestowal of 11 medals and eight certificates of merit by the Joseph A. Holmes Safety Association at its annual meeting held in Washington, D. C., April 18. Outstanding records in safety achievement made by 124 mining companies or other organizations of the mineral industries were recognized by the award of certificates of honor. Thirty-two certificates of honor were given to individuals for notable safety records. The Joseph A. Holmes Safety Association, named in honor of the first director of the Bureau of Mines, United States Department of the Interior, is closely affiliated with that Bureau. The meeting was held in the conference room of the Bureau of Mines and was presided over by Dr. John W. Finch, director of the Bureau. The number of certificates awarded was the largest in the history of the association.

Medals were presented to Grover Jarrett and E. Z. Baskin, employees of the Winifrede Collieries, Winifrede, W. Va., in recognition of saving the life of E. T. Belcher on July 19, 1938. Jarrett and Baskin freed Belcher

from a trolley wire against which he had been pinned, and resuscitated him after administering artificial respiration for four hours.

A medal was given to Oliver Busby of Wylam, Ala., for saving the life of Coleman Burrell, who suffered an arterial hemorrhage, after being caught beneath the wreckage of runaway cars at Wylam No. 8 coal mine of the Tennessee Coal, Iron and Railroad Company. Busby, at great risk from loosened overhead rock crawled beneath a car, applied the necessary pressure to stop the hemorrhage, and at the same time directed the work of resetting timbers. The risk was so great that he would not allow other workers to join him.

Willie Vickers, an employee of the Tennessee Coal, Iron and Railroad Company at the Wylam mine, Wylam, Ala., was awarded a certificate for his resourcefulness in saving the life of Richard Wilder, who had sustained a punctured artery, on February 21, 1938. Vickers stopped the flow of blood through his deft work in making a tourniquet of a piece of fuse.

Dr. Jesse Maddox and his son, Dr. John D. Maddox, of Moberly, Mo., were awarded medals as the outstanding heroes in the rescue work following a disaster at the Esry coal mine on August 18, 1936. The two doctors, after working on the surface for four days in giving medical attention to members of rescue squads, descended into the mine to administer emergency treatment to four critically injured miners. After working in a gaseous atmosphere under extreme difficulties for some hours, they succeeded in saving the lives of A. W. McCanne and Demer Sexton.

Sam Guarino, employed at the Edgewater coal mine of the Tennessee Coal Iron and Railroad Company,

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Pratt City, Ala., was given a medal for the saving of the life of Louis Tunnello, pinned beneath a fall of coal on July 16, 1938. In the vicinity of burning fuses, and with but a few minutes in which to act, Guarino dragged Tunnello to a place of safety before the charges exploded.

Medals were bestowed on Sam McCoy of Durango, Colo., and Dick Bower, of Los Angeles, Calif., for attempting to save the life of Dan Glasgow at the old Troy shaft near Granite, Colo., on July 8, 1938. In dewatering the abandoned shaft, Glasgow was overcome by gasoline engine exhaust fumes and fell 60 feet to the bottom of the shaft. McCoy and Bower, who were merely passers-by, learning of his predicament, volunteered to attempt a rescue. While bringing Glasgow to the surface, both men were seriously affected, it being necessary to administer artificial respiration to Bower.

Medals were bestowed on Joe Zuniga and William Paterson, employees of the Hayden Coal Co., Haybro, Colo., who, with others, saved the life of Thomas Greenhalgh, mine superintendent, pinned beneath a rock fall on November 9, 1937.

Henry E. Cooper, an employee of the Blue Diamond Coal Co., Eagan, Tenn., was awarded a medal in recognition of prompt action in saving the life of Lawrence Chambers on September 14, 1938. Cooper rescued Chambers from contact with an underground trolley wire, and, through artificial respiration, brought him back to consciousness and ultimate recovery.

The Association awarded certificates of honor for extraordinary safety achievement to 66 coal mines or mining companies, to 33 metal or nonmetallic mineral mines or mining companies, to 15 quarries and cement plants, to eight petroleum organizations, and to two miscellaneous organizations.

In his annual report to the Association, President John W. Finch, director of the Bureau of Mines, stated that the publication of records of safety accomplishment in the mining and allied industries is of definite aid to those industries in combating the criticism directed toward them on account of alleged failure to give sufficient care and attention to accident prevention. Moreover, the publication of the numerous ways in which safety in mining is being attained by the recipients of the awards acts as a strong stimulus to those in the industry who may be somewhat inclined to lag in attention to the fundamentals of safety of operation. He referred to favorable comment made several times recently in the foreign technical press regarding the work and accomplishments of the Association.

Data for the awards were assembled under the direction of D. Harrington, chief, Health and Safety Branch, Bureau of Mines, secretary of the Association, who in his annual report stated that the year 1938 was not particularly remarkable for progress in safety in the mining and allied industries. The business recession

appeared to be accompanied by a "let down" in safety effort and consequently in safety accomplishment. The "let down" was not very serious, however, and tentative figures indicate that coal mining at least, while having a safety record poorer than in 1933 or 1936 or 1937, was about on a par with what was done in 1934 and 1935 but much better than in any year preceding 1933. The really disquieting feature of coal mine safety at the present time is the gradual increase in the number and seriousness of coal mine explosion and fire disasters since the alltime low occurrence of them in 1933 and the really good record of 1934. The years 1937 and 1938 had 12 major coal mine disasters with a total of 185 fatalities while the years 1933 and 1934 had but three with a total of 29 fatalities. The trend as to disasters is by no means good and our coal mining people need to take heed as to what is occurring and then to take steps to see that measures are kept in effect so these frightful occurrences are eliminated.

Central Iron Ore Conditioning Plant for T. C. I. & R.

Plans for construction of a central ore conditioning and sintering plant at Wenonah, Ala., were announced recently by Robert Gregg, president of the Tennessee Coal, Iron and Railroad Company, a United States Steel Corporation subsidiary.

Construction will be started within the next few weeks. The new plant will be located near Wenonah Ore Mine No. 7.

"For the past several years," Mr. Gregg said, "this company has been giving considerable study to improved methods of preparing its iron ore for efficient smelting in its blast furnaces. Extensive research has resulted in this decision to install equipment of sufficient capacity to handle the company's current ore requirements. The United States Steel Corporation agrees with our findings and has appropriated funds for the program."

Crushing ore at the individual mines will be discontinued. Ore will be loaded directly into railroad cars at the mines and transferred to the central ore conditioning plant, where the ore will be dumped into primary crushers. After preliminary crushing, the ore will be conveyed by belt conveyor to a second crushing station for final reduction. Leaving the secondary crusher, the ore will go to a screening and continuous sampling station, where it will be separated into three sizes—coarse, medium and fine.

Coarse and medium grade ores will be sent to storage in steel silos, and chemical analyses will be made while the ore is held in storage. For removal to blast furnaces, ore will be fed from silos by proportional feeders according to definite standards of chemical analysis.

The fine grade ore will be conveyed from the screening station to storage

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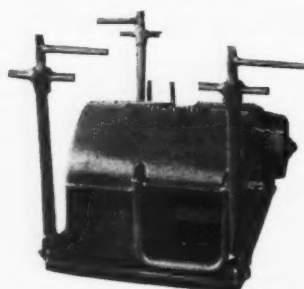
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bins at the sintering plant. Flue dust from the company's blast furnaces and coke braize also will be stored in adjacent bins. A portion of the fine ore will be mixed with the flue dust and coke braize and sintered—brought to a temperature sufficient for fusing.

Some alterations of ore stocking facilities at the Tennessee Company's Fairfield blast furnaces will be required to coordinate the ore conditioning program. It is estimated that the plant will be ready for operation by late summer or autumn of 1940.

New Illinois Washing Plant

One of the most modern coal preparation plants in Illinois began operation late in March at the Mt. Olive and Staunton Coal Company's Staunton mine. The plant has been under construction during the past 5 months, and is equipped with a Jeffery washer, with a capacity 400 tons per hour.

Another Reader Comments on

S.E.C. Form A-O-1

To the Editor:

I have read, with interest, Mr. Maury's letter; but I demur to the parallel he draws between apples in an orchard and ore in a mine. The trees in his orchard can be counted, if one will take the trouble. The number, and even to some degree the quality, of apples is readily apparent; whereas the quantity and value of ore in a mine often cannot be ascertained, with comparable certainty, until it has been mined and milled or smelted, this being specially true of gold ore in irregular veins. Underground we see only limited exposures, which are imperfectly sampled around the periphery only. Valuation at best is a matter of judgment and experience, applied to these imperfect data.

With exceptionally uniform ore bodies, reasonable certainty can be obtained if they are exposed on four, or even three edges. Most of us whose experience has continued long enough will, however, remember many instances in which ore bodies so "blocked out" have yielded much less than the estimates. Speaking generally, my experience has been that "proven" ore (using the definitions in Form A-O-1) has yielded much less, and "probable" ore much more, than the estimates. With vein deposits, safety in valuation and uniformity of output are better secured by a large number of ore exposures than by intensive development of one or two.

The answer to Mr. Maury is, I think, that things which can be seen, and accurately measured and counted, should be listed separately from those which can only be estimated, but that ore reserves in the great majority of mines do not come in the former category. The attempt to set up two different classes into which evidence of the existence of ore must be divided

tends to encourage a rather dangerous form of buncombe. If the terms used were "proved" and "partly proved," they would be somewhat less objectionable, if it could be made clear that proved ore is merely an estimate based on evidence afforded by such openings as are economically made preparatory to mining; which again depends on the judgment of the engineer. There is no safe way of getting around individual judgment, and no sound way of mechanizing the business of mine valuation.

By over-emphasis on the value of—and in some cases the necessity for—"blocking out" ore bodies in irregular deposits, the mining departments both of RFC and SEC have, in my opinion, performed a serious disservice to the mining industry, and have contributed to the failure of both Commissions to carry out the intentions of Congress.

GEORGE E. COLLINS.

Denver, Colo.

Goodman Manufacturing Company Elects New Officers



Wm. E. Goodman

May 15, 1939,
of Charles H.
Strawbridge.

At the same meeting Loyal F. Crawford and Arthur C. Green, sales manager, were both elected vice presidents.

The progressive policies of the company, which have lift-

ed it to a leading position in the manufacture of mechanical equipment used in modern coal and metal mine operations since its incorporation in 1900, are assured continuation under Mr. Goodman's leadership.



Loyal F. Crawford



Arthur C. Green

Coal Division Set Up in Interior

Shortly before the July 1 deadline, when the final curtain was rung down on the activities of the National Bituminous Coal Commission, as such, and its functions transferred to the Department of the Interior, Secretary Ickes announced the formation of a new Bituminous Coal Division in his department to administer the Guffey Act. Heading the division is Howard A. Gray, a former Chicago architect and long time head of the Public Works Administration who has been one of Mr. Ickes' most trusted aides. Second in command of the new division is Dan H. Wheeler who for the past six years has also been a member of the staff of the PWA, as attorney in charge of administrative matters in the Legal Division and as Director of the Projects and Statistics Division. Named to the important post of general counsel is 29-year-old Abe Fortas, also from the PWA where he has been general counsel under Mr. Gray. Named as technical adviser to the director of the Division is Percy Tetlow, former chairman of the Coal Commission.

Before closing shop, the old Commission virtually cleaned its slate of pending business which it had aimed at finishing before the deadline. Average costs of production for all districts have been announced, coordination of prices completed, and minimum prices approved for Price Area 1. Also, final hearings on prices for the Rocky Mountain and Pacific Coast areas were held during the past month, and marketing rules and regulations announced.

Minimum prices for Price Area 1 are of course subject to final hearing which will begin in Washington July 24. The prices are generally lower than the first minima established by the Commission in December 1937 and January 1938, although quotations for certain coals are substantially higher than the present market prices while prices for other coals are considerably lower.

The new Coal Division was concentrating early in July on schedules for Price Areas 2, 3, 4 and 5.

Philippine Mining Year Book, 1939, edited by Ralph Keeler and Others. Official publication of the Chamber of Mines of the Philippine Islands. 9 by 12 inches, 282 pages including advertisements, \$1 postpaid from Ralph Keeler, publisher, Post Office Box 769, Manila.

Extensive development of the gold mines of the Philippines was delayed for many years, but the higher price paid for gold, the optimism of several businessmen, the investment of millions of capital and considerable speculation, the influx of hundreds of American engineers and employment of 70,000 natives, and the successful metallurgical treatment of the ores resulted in 1938 in an output of 64,000,000 pesos (2 pesos equals \$1) and dividends of 23,654,000 pesos. Production in 1916 was 3,012,000 pesos. One mine, the Balatoc, yielded more than four times this amount last year and the Benguet Consolidated nearly four times. Of the 28 gold producers, two were dredging projects (Coco Grove and Tambis). In addition there were 15 base-metal mines, the largest being on iron ore (Philippine Iron and Samar), copper (Lepanto), chromite (Consolidated and Florannie).

A full-page locality map spots all the mineral producers and where other minerals have been found. Six pages list the staff members of all the mines, four pages the directors,

one and a half pages the engineers licensed, and four pages a glossary of terms in native dialects and in Spanish, some rather tersely translated. More than 300 photos of men, places, mines, operations and people are well reproduced. There are signed articles of several pages each on early and current mining, some details of companies, safety measures, metallurgy at the Demonstration mine, smelting concentrates at Mambulao, dredging, flying, the Philippine Bureau of Mines, dividend and production tables, and keeping house in a mining camp (by a woman writer), all with pictures.

PUBLICATIONS of INTEREST

U. S. BUREAU OF MINES

BULL. 269. LIMITS OF INFLAMMABILITY OF GASES AND VAPORS, by H. F. Coward and G. W. Jones. 146 pp. 20 cents.

MINERS' CIRCULAR 38. SOME SUGGESTIONS ON SAFETY IN TIMBERING ANTHRACITE MINES, by R. D. Currie. 21 pp. 20 figs. 10 cents.

T. P. 593. ALLAYING DUST IN BITUMINOUS COAL MINES WITH WATER, by D. Harrington, J. J. Forbes, F. E. Cash, E. H. Denny, C. A. Herbert, D. J. Parker, C. W. Owings and A. U. Miller. 55 pp. 21 figs. 15 cents.

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Principal Mining Areas

BULLETINS TELL THE STORY

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MISCELLANEOUS

- A BRIEF ON THE SUBJECT OF TAXATION OF MINES, prepared and submitted by Idaho Mining Association, Boise. 35 pp. 8 tables. 7 charts.
- BULL. 49. COUNTY SERIES No. 2, VIRGINIA GEOLOGICAL SURVEY. OUTLINE OF THE GEOLOGY AND MINERAL RESOURCES OF RUSSELL COUNTY, VA., by Herbert P. Woodward. 91 pp. 13 plates. 9 figs. 8 tables.
- BULL. 50. VIRGINIA GEOLOGICAL SURVEY. GROUND-WATER RESOURCES OF NORTHERN VIRGINIA, by R. C. Cady. Prepared in cooperation with the U. S. Geological Survey. 200 pp. 7 plates. 5 figs. 42 tables.
- BULL. 53. VIRGINIA GEOLOGICAL SURVEY. BARITE DEPOSITS OF VIRGINIA, by Raymond S. Edmundson. 85 pp. 15 plates. 15 figs. 2 tables.
- NO. 788. CANADA DEPARTMENT OF MINES AND RESOURCES. INVESTIGATIONS IN ORE DRESSING AND METALLURGY (TESTING AND RESEARCH LABORATORIES). July to December, 1937. 137 pp.
- PAMPHLET No. 46. IDAHO BUREAU OF MINES AND GEOLOGY. GEOLOGY AND ORE DEPOSITS OF THE FLORENCE MINING DISTRICT, IDAHO COUNTY, IDAHO, By John C. Reed. Prepared in cooperation with the U. S. Geological Survey. 44 pp. 1 plate. 18 figs.
- THE DYNAMICS OF AUTOMOBILE DEMAND. Based upon papers presented at a joint meeting of the American Statistical Association and the Econometric Society in Detroit, Mich., on December 27, 1938. 139 pp. 58 charts.
- ELECTRIC POWER STATISTICS, 1938. Federal Power Commission, March, 1939. 54 pp. 15 figs. 21 tables. 25 cents.

PERSONALS



CHARLES E. LAWALL has been elected president of West Virginia University. His permanent appointment is fitting tribute to the fine record he has made at the University—first as director of the School of Mines, and since last September as acting president of the University.



J. F. JOY has closed his consulting offices in Pittsburgh and has moved his residence to Wyn-Hof Apartments, 14th Street, Franklin, Venango County, Pa.

R. D. LONGYEAR, president of the E. J. Longyear Company of Minneapolis, Minn., sailed from Seattle, June 16 for Alaska, where he will spend the summer on mine examination work. R. C. GEBHARDT, mining engineer and geologist of the company, is also in Alaska, having sailed three weeks ahead of Mr. Longyear.

EDWARD P. ARTHUR, mining engineer of Cripple Creek, Colo., and former State Senator from Teller County has been appointed state mining commissioner of Colorado, succeeding JOHN T. JOYCE, whose term expired June 1.

MARSHALL L. HAVEY has been elected a vice president of the New Jersey Zinc Company, effective June 1, according to an announcement by J. E. Hayes, president.

The company also announces the following changes in organization pertaining to the New Jersey Zinc Company and the New Jersey Sales Company: RALPH L. NEUMANN has been appointed general sales manager, and will also continue as manager of the Pigment Division of the New Jersey Zinc Sales Company; and ARTHUR E. MERVINE has been appointed assistant general sales manager, continuing as manager of the Metal Division of the New Jersey Zinc Sales Company.

CLINTON H. CRANE, president of the St. Joseph Lead Company, was reelected president of the Lead Industries Association at their annual meeting held recently in New York. Other officers reelected were F. H. BROWNELL of the American Smelting and Refining Company; F. W. ROCKWELL of the National Lead Company, vice president; and F. E. WORMSER, secretary and treasurer.

R. C. ALLEN, executive vice president of Oglebay, Norton & Company, Cleveland, received the honorary degree of Doctor of Engineering at the commencement exercises at Rensselaer Polytechnic Institute, Troy, N. Y.

J. D. FRANCIS, president of the Island Creek Coal Company, was conferred the honorary degree of Doctor of Laws at the 102nd commencement of Marshall College in Huntington, W. Va.

EARL N. GRAF has been appointed manager of the Pittsburgh, Pa., branch office of John A. Roebling's Sons Company, of Trenton, N. J. The branch office is located at 855 West North Avenue.

DONALD B. GILLIES, vice president of Republic Steel Corporation and president of American Institute of Mining and Metallurgical Engineers, was awarded the honorary degree of Doctor of Science at the commencement exercises of Montana School of Mines at Butte, in recognition of a life time of service to mining.

W. ROBERT TIMKEN has been appointed assistant to the president of the Timken Roller Bearing Company, Canton, Ohio.

PETER F. LOFTUS, consulting engineer of Pittsburgh, Pa., was the recipient of an honorary degree of Doctor of Laws at the annual convocation of Ottawa University.

EDGAR H. GRAFF, safety director of the New River Company for the past several years, was recently promoted to assistant manager of mines. In addition to performing his new duties, he will continue to direct the safety work of the company.

BROOKS FLEMING, JR., director of the Employees' Service Department of Consolidation Coal Company, was recently placed in charge of Workmen's Compensation in the company's four divisions. J. H. HAMPSON, acting personnel manager of the Maryland and Pennsylvania divisions of the company, has been named compensation administrator of the same two divisions.

L. KENNETH WILSON has been appointed geologist for the Cord Mining Interests at Silverpeak, Nev. The Cord Interests operate the Prescott Lease on the Black Mammoth Consolidated properties, one of Nevada's largest gold producers in 1938, which is handling 575 tons of gold ore daily, and employing over 200 men. A. N. SWEET, of Silverpeak, Nev., is general manager of the Cord Interests.

A mining committee from the National Lead Company of New York, composed of ANDREW MAYER, chief engineer, New York; L. G. REICHARD, production manager, New York; GEORGE C. HEIKES, chief mining engineer of St. Louis Smelting and Refining Company; JOSEPH A. MARTINO, assistant comptroller, New York; JEAN MCCALLUM, assistant manager of National Lead Company, St. Louis; J. J. MORSMAN, director of National Lead Company from Chicago; and R. L. HALLETT, chief chemist of National Lead Company, New York, visited the company's properties located in Utah early in June. They were accompanied by E. H. SNYDER, vice president and general manager of the Combined Metals Reduction Company; WILLIAM H. KELSEY, chief engineer of the Combined Metals Reduction Company; and B. G. SWEET, assistant treasurer of the Combined Metals Reduction Company.

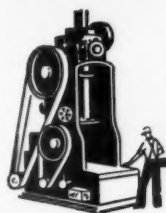
—Obituaries—

MAURICE DENN, director of the Shattuck-Denn Mining Corporation and one of the founders of the original Shattuck Arizona and Denn Arizona Copper Companies, died May 27 at Redondo Beach, Calif., at the age of 84.

W. E. SMITH, attorney and successful mine prospector of Tucson, Ariz., died in Sudbury, Ontario, May 25 at the age of 57.

HARRY HOWARD WEBB, world famous mining man who was for 23 years general manager of the Cecil Rhodes properties in the Rand, died June 2 at his country estate near Santa Barbara, Calif., after a long illness. His age was 85.

T. F. COLE, former president of the Oliver Iron Mining Company and active in early development of the Calumet and Arizona Mining and New Cornelia Copper Company, died at his home in Pasadena, Calif., June 3. His age was 77.



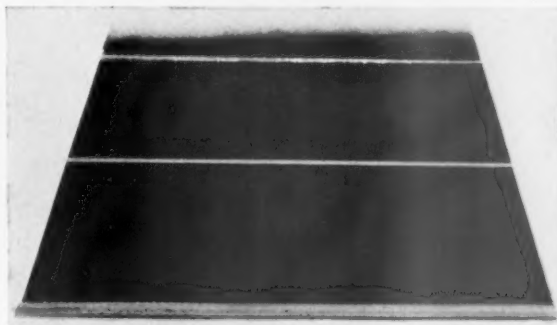
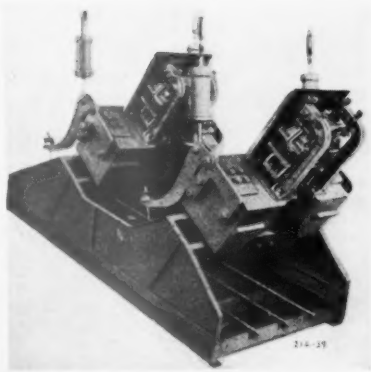
MANUFACTURERS' Forum

New Type Screen Cloth

A new type of screen cloth has been introduced recently by The Jeffrey Manufacturing Company. This new product is made of piano wire, unusual in that the wires run in one direction only with no cross wires.

This screen cloth is stretched to such a high tension that the individual wires develop a resonance having the peculiar property of passing undersize particles much more rapidly than the conventional types of cloth. In addition, the manufacturer claims that this piano wire has much greater capacity and longer life, with almost complete freedom from blinding.

Due to the great tension placed on



the wires it is necessary that the screen sash holding them be specially constructed. At present the cloth is made in meshes from $\frac{1}{8}$ in. to 120

mesh, and can be furnished in stainless steel where required.

Above view shows new type piano wire cloth applied to a Jeffrey-Traylor 4-ft. by 10-ft. electric vibrating Conveyanscreen. A close-up of a section of this screen cloth is also illustrated.

Complete information covering this new type cloth may be had by writing The Jeffrey Manufacturing Company, Columbus, Ohio.

WALTER GEIST has been appointed vice president of Allis-Chalmers Mfg. Co., according to a recent announcement by Max Babb, president of the company. Mr. Geist entered the employ of Allis-Chalmers in 1909, since



when he has advanced through various positions and departments from which he derived broad knowledge and experience of its various products. He originated the idea of the multiple V-belt drive principle of power transmission, known as the Texrope drive, which has revolutionized power transmission practices.

tions too confined to admit a standard size jack. Although this powerful little tool only weighs 46 lbs., it is especially valuable for use in repairing cranes, locomotives, etc., and in



All-Manganese Slushing Scrapers

Alloy Steel & Metals Co., Los Angeles, Calif., manufacturers of mine and mill equipment, announce that production will soon begin on a new style of all-manganese steel scrapers for mine slushing operations.

These improved scrapers will be built in seven sizes ranging from 30 in. to 66 in. in width in light, heavy and deep models of open, quarter, half and full box type.

In conjunction with the new line of scrapers the company will also manufacture three new and improved types of sheave blocks for mine service. The Super-Duty model will feature side plates and sheave of manganese steel with Sealed-for-Life bearings. The Hevi-Duty model will be similarly built with side plates of cast steel. The Standard model is furnished with cast steel sheave and side plates with Oil-lite bearing.

The sheave blocks will be built in various sizes from 8 in. to 16 in.

Additional data on this new equipment may be secured from the company on request.

Light-Weight Hydraulic Jack

The Rochester Machine Co., 133 Virginia Ave., Rochester, Pa., has developed a light-weight, compact, easy-to-handle hydraulic jack, having a 50-ton rated capacity, for use in loca-

general for moving heavy machinery and other objects where a larger jack of the same capacity would be inaccessible.

Descriptive literature will gladly be supplied upon request.

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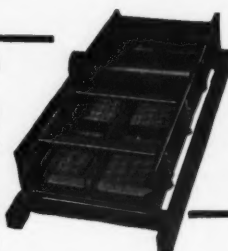
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